Department of Mechanical Engineering
University of New Brunswick
Fredericton, N.B.

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TP 7521E

TANK CAR THERMAL RESPONSE ANALYSIS: VOLUME 8

TANK SIMULATOR TEST DATA

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Prepared For:

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17. Abstract

The R11 experimental data for nine tank simulator tests are presented. In addition to the detailed tabulation of results, measurement plots of tank pressure and liquid and vapour space as well as wall temperatures are given as functions of time for the range of wall heat fluxes ($q(kW_e/m^2)$), fill levels and valve orifice diameters tested. Several tests were conducted with an EXPLOSAFE annulus attached to the inner tank wall.

18. Key Words	19. Distribution Statement
Accidents, BLEVE, Boiling, Fires, Pool, Propane, Railway, Tank Car, Thermal Response, Protection	Limited number of copies available from the Transportation Development Centre

20. Security Classification (of this report)	21. Security Classification (of this page)	22. No. of Pages	23. Price
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9. Nom et adresse de l'organisme exécutant Fire Science Centre Université du Nouveau-Brunswick C.P. 4400 Fredericton, N.B. E3B 5A3	10. Nº de dossier — ASC 11SD.T8200-2-2509
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12. Nom et adresse de l'organisme parrain Centre de développement des transports (CDT) Complexe Guy-Favreau 200 ouest, boul. Dorchester, Suite 601, Tour Ouest Montréal, Québec H2Z 1X4	13. Genre de rapport et période visée
	14. Code de l'organisme parrain CDT 4727
15. Remarques additionnelles Voir aussi "Tank Car Thermal Response Analysis: Executive Summary", par J.E.S. Venart, mars 1985, TP 6809E.	16. Agent de projet — CDT D.W. Dibble

17. Résumé

Ce rapport présente le résultat de neuf essais de simulation utilisant un petit réservoir rempli de frigorigène R11 à des niveaux variables. Outre les tableaux détaillés des résultats, il montre l'évolution dans le temps des valeurs de pression dans le réservoir, de l'espace occupé par la cargaison ainsi que de l'espace vide au-dessus de celle-ci et enfin de la température des parois, en fonction des flux thermiques exprimés en kW_e/m^2, du niveau de remplissage et du diamètre de la soupape de sûreté. Certains essais ont été faits alors qu'une garniture annulaire EXPLOSAFE était fixée à la paroi intérieure du réservoir.

18. Mots-clés	19. Diffusion
Accidents, BLEVE, ébullition, flammes enveloppantes, propane, rail, wagon-citerne, comportement thermique, protection	Le Centre de développement des transports dispose d'un nombre limité d'exemplaires.

20. Classification de sécurité (de ce rapport)	21. Classification de sécurité (de cette page)	22. Nombre de pages	23. Prix
non classifié	non classifiée	301	—

CDT/TDC 79-005

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TEST DATA NUMBER 7	69
TEST DATA NUMBER 13	103
TEST DATA NUMBER 14	138
TEST DATA NUMBER 15	171
TEST DATA NUMBER 16	204
TEST DATA NUMBER 17	234
TEST DATA NUMBER 18	266
CHANGE OF LIQUID LEVEL WITH TIME	298
TEST 15	299
TEST 16	300
TEST 17	301

PLOTS OF A TEST

CARRIED OUT ON THE UNB TANK 2

WITH EXPLOSAFE

TEST NUMBER 5

Q in = 40 kW/m sq

LIQUID LEVEL = 76 %

SET PRESSURE = 25 psig

PRV ORIFICE DIAMETER = 3/8 in.

Date of Test AUG 17, 1983

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Thermocouple Grid Layout - - - - - - - - - - - - - 3

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2. Thermocouples Placed in the Four Quadrants in a Vertical Plane: Temp. Vs. Time - - - - - - 19

Thermocouple Grid Layout - - - - - - - - - - - - 21

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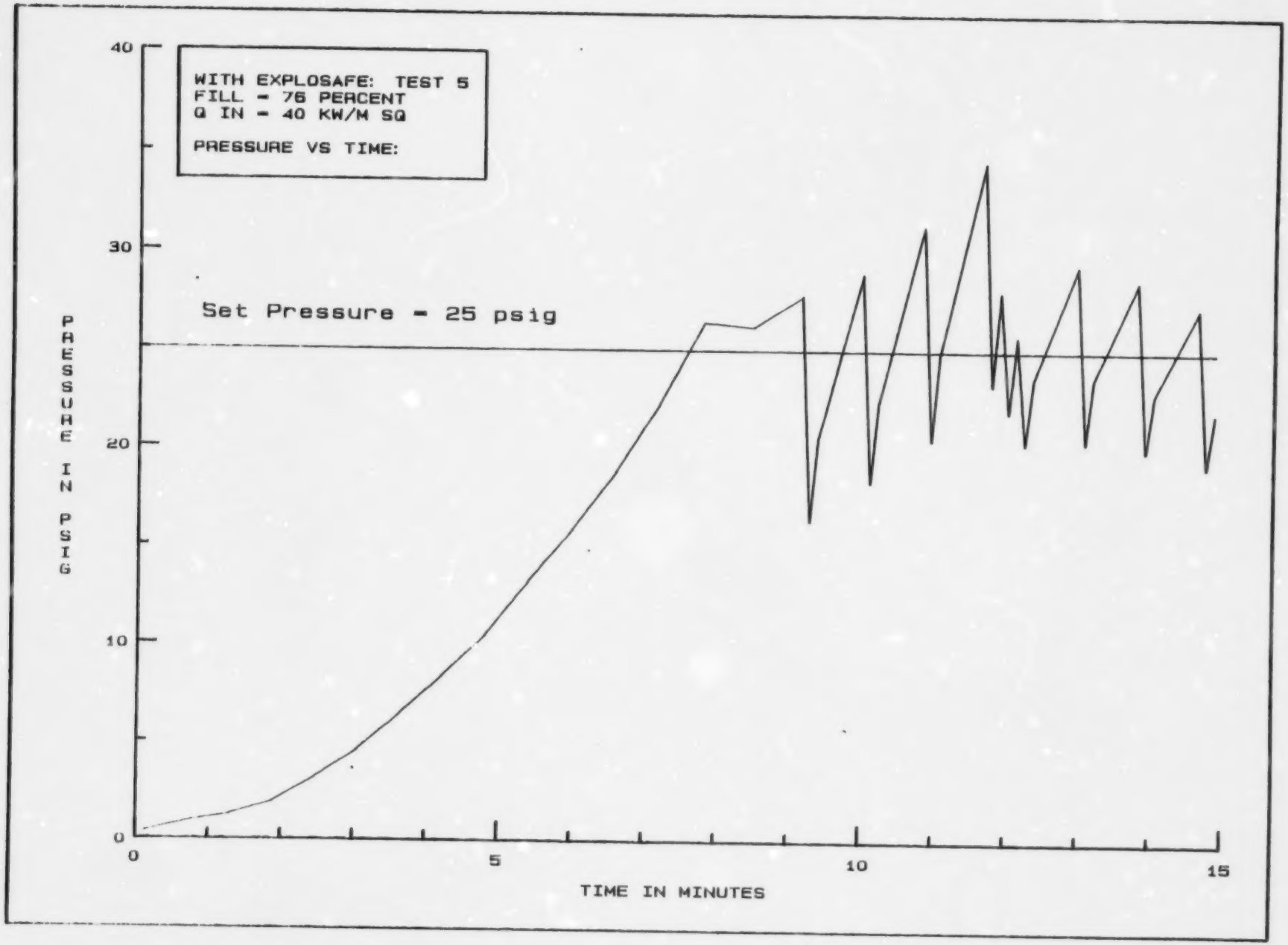
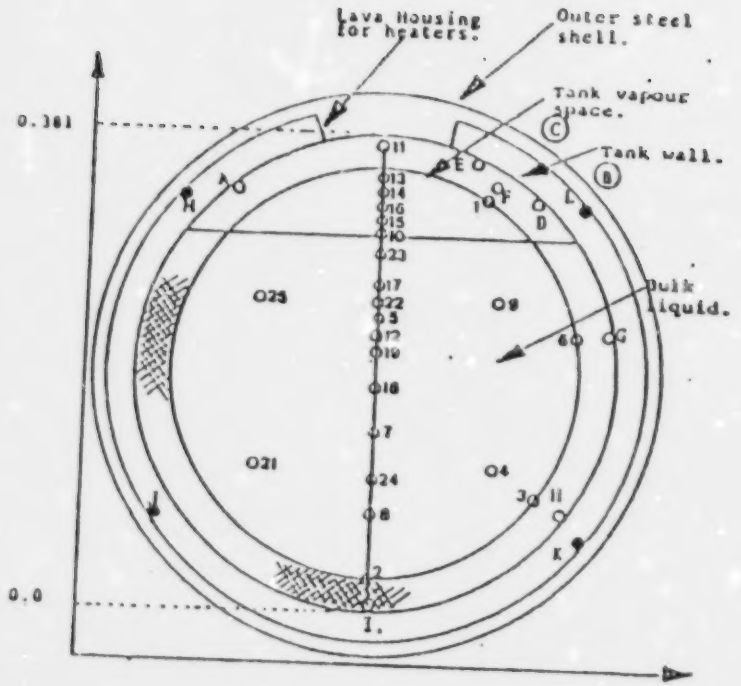

WITH EXPLOSAFE: TEST 5
FILL - 76 PERCENT
Q IN - 40 KW/M SQ
PRESSURE VS TIME:
Set Pressure - 25 psig
PRESSURE IN PSIG
TIME IN MINUTES
0
10
20
30
40
0
5
10
15



SYMBOL	Thermocouple #	Angle(Deg)
A	26	308
B & D	27 & 29	55 & 55
C & E	28 & 30	25 & 25
G & H	36 & 37	86 & 138
I	34	180
J & K	31 & 36	220 & 135
L & M	33 & 32	50 & 295

Circled thermocouples are ½ the depth of the tank back from thermocouples D & E

Number 41 represents pressure in psig.
Number 42 represents time in seconds.

Thermocouple numbers.	Height (cm)	Angle with the vertical (Deg.)	Doubtful or faulty Thermocouple.
34	0	180	-
02	2.54	-	-
08	12.15	-	-
24	15.55	-	-
07	17.56	-	-
18	20.05	-	-
19	22.6	-	-
12	23.7	-	-
05	24.75	-	-
22	25.8	-	-
17	26.8	-	-
23	28.85	-	-
10	29.9.	-	-
15	30.9	-	-
16	31.9	-	-
14	32.9	-	-
13	33.95	-	-
11	36.5	-	-
1 & 35	-	42	-
6 & 3	-	86 & 138	-
9 & 25	20.35	-	-
4 & 21	12.20	-	-
30 & 28	-	25 & 25	-
29 & 27	-	55 & 55	-
26	-	308	-
38 & 37	-	86 & 138	-
31 & 31	-	135 & 220	-
32 & 33	-	295 & 50	-
20 & 40	Reference temperature	-	-

Fig. III.C A grid layout of thermocouples for an Explosafe equipped vessel. (Valid for 74, 58 and 23 percent liquid full cases)

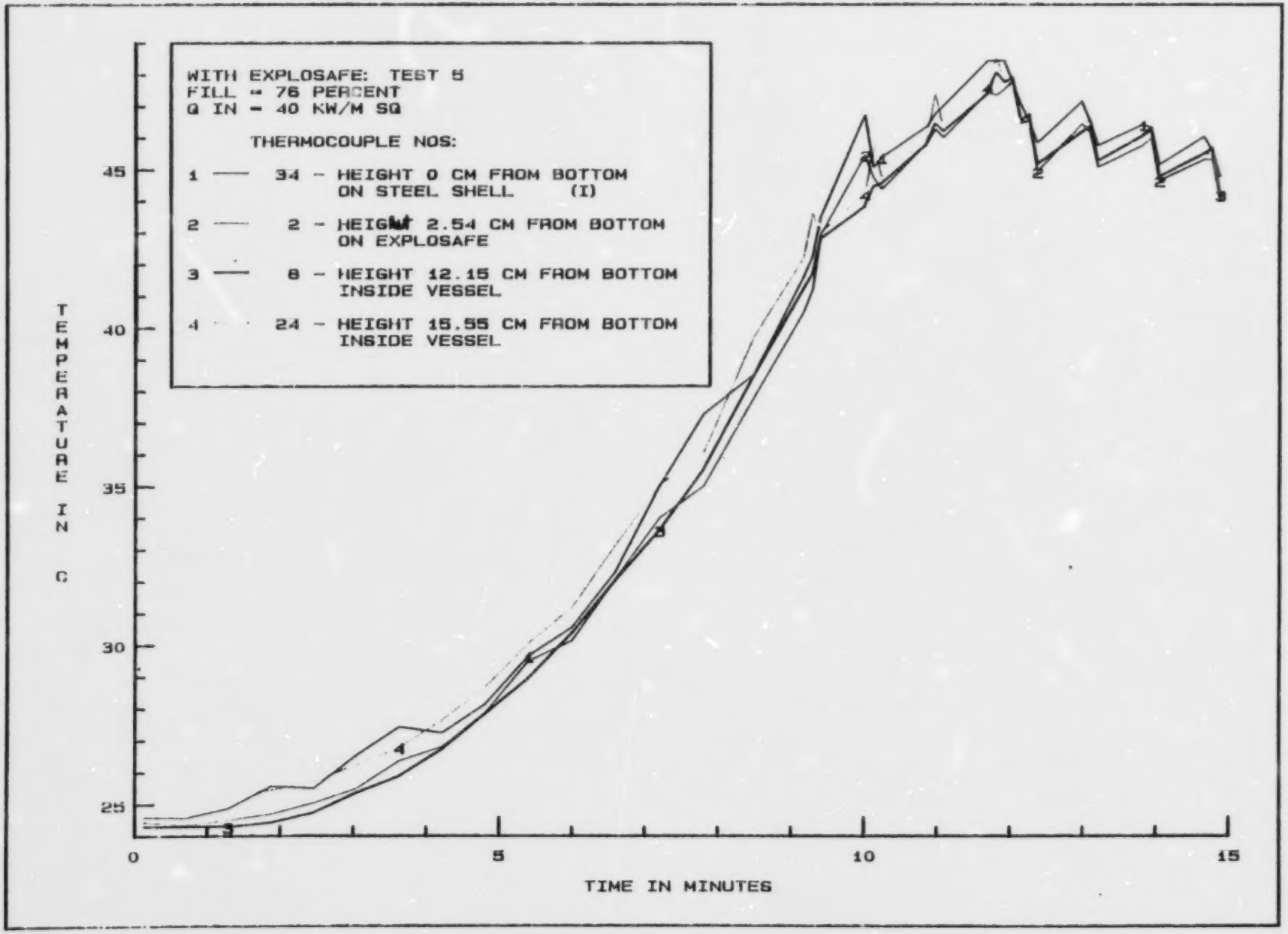
FOLLOWING THERMOCOUPLES ARE PLACED

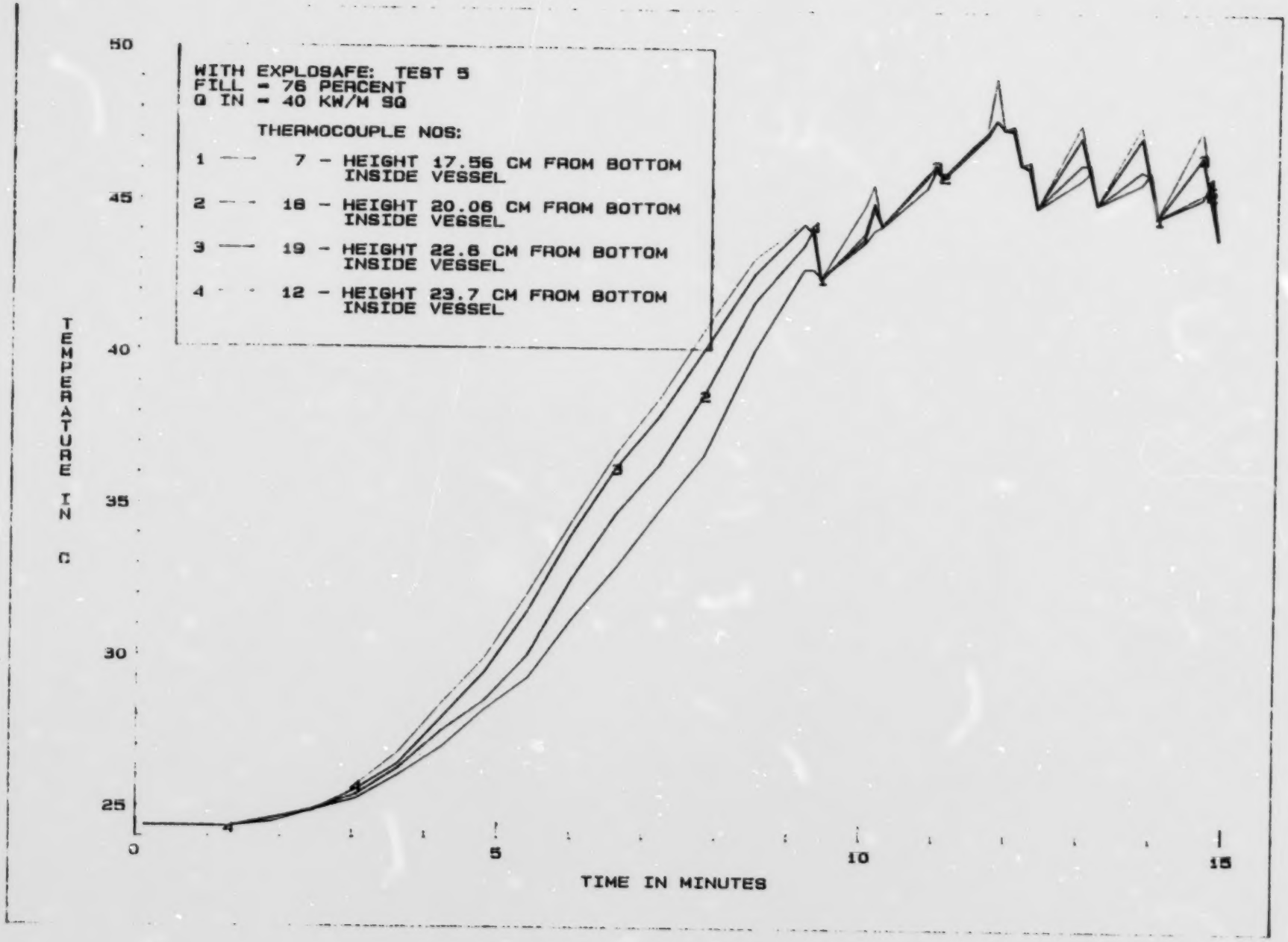
AT THE CENTRE OF THE VESSEL (DIA. 38.1 CM)

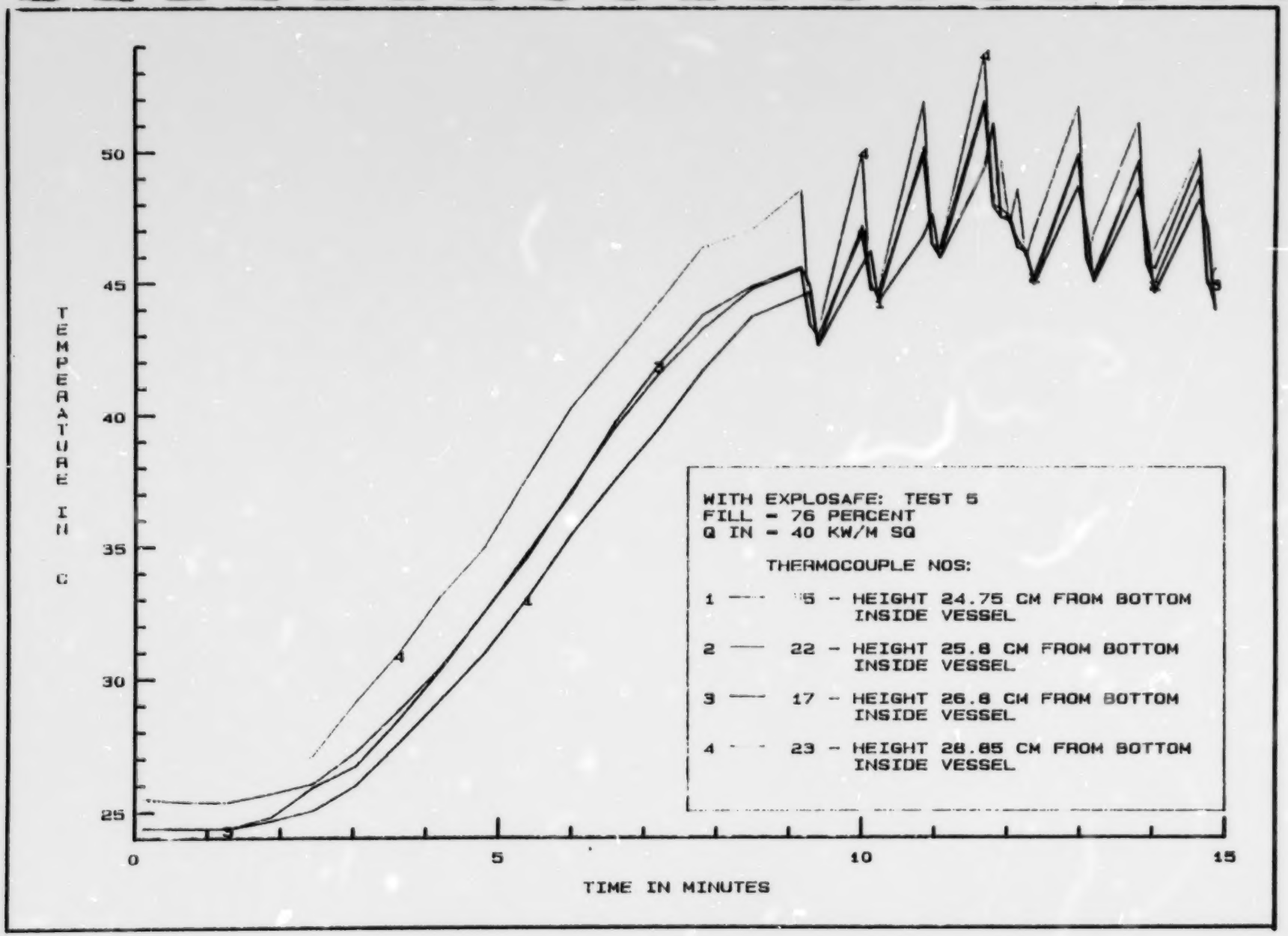
IN A VERTICLE AXIS

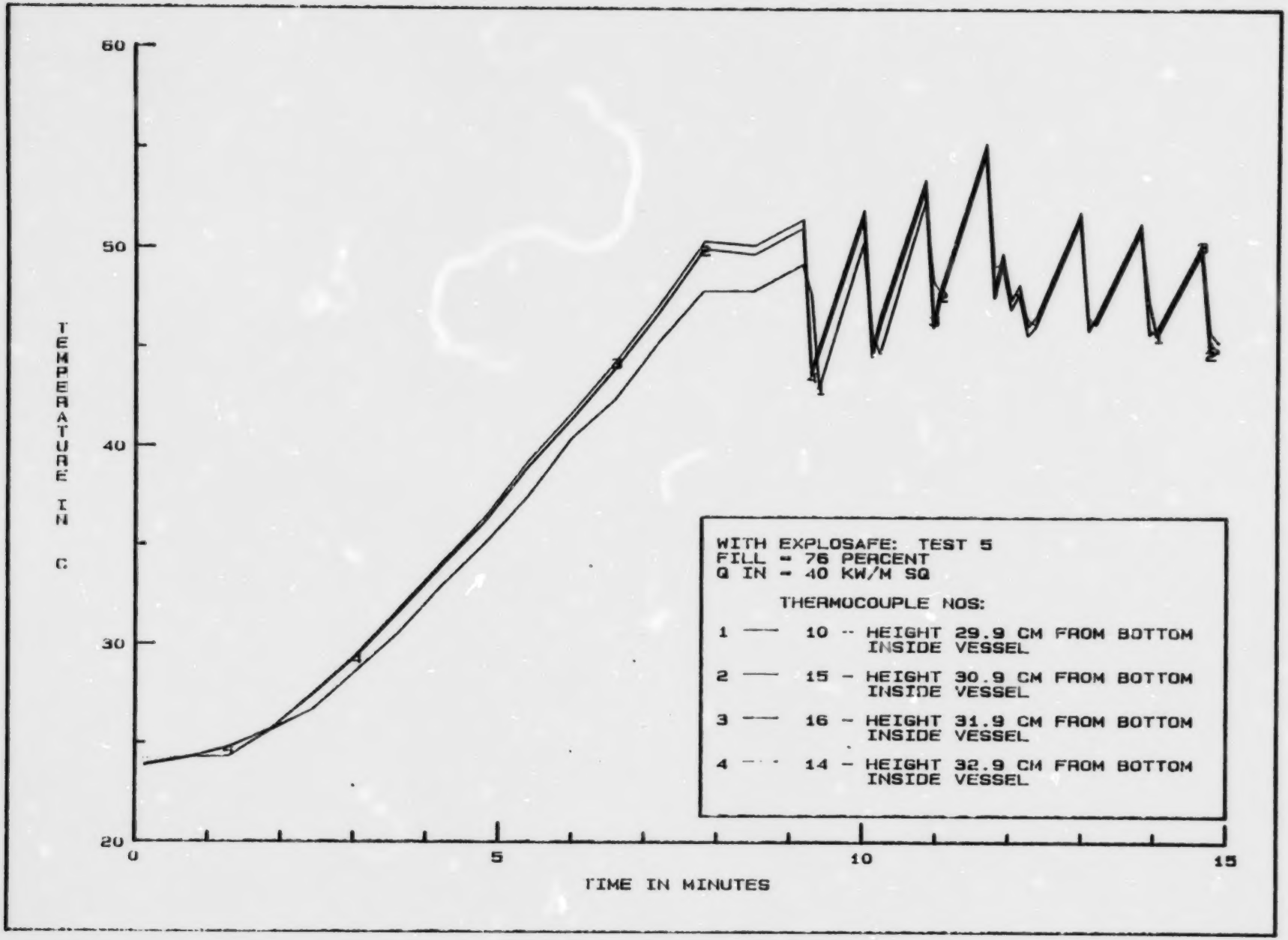
THERMOCOUPLE NUM.	HEIGHT FROM BOTTOM IN CM
34 CR I	0
2	2.54
8	12.15
24	15.55
7	17.56
19	20.06
18	22.6
12	23.7
5	24.75
22	25.8
17	26.9
23	28.85
10	29.9
15	30.9
16	31.9
14	32.9
13	33.95
11	36.5

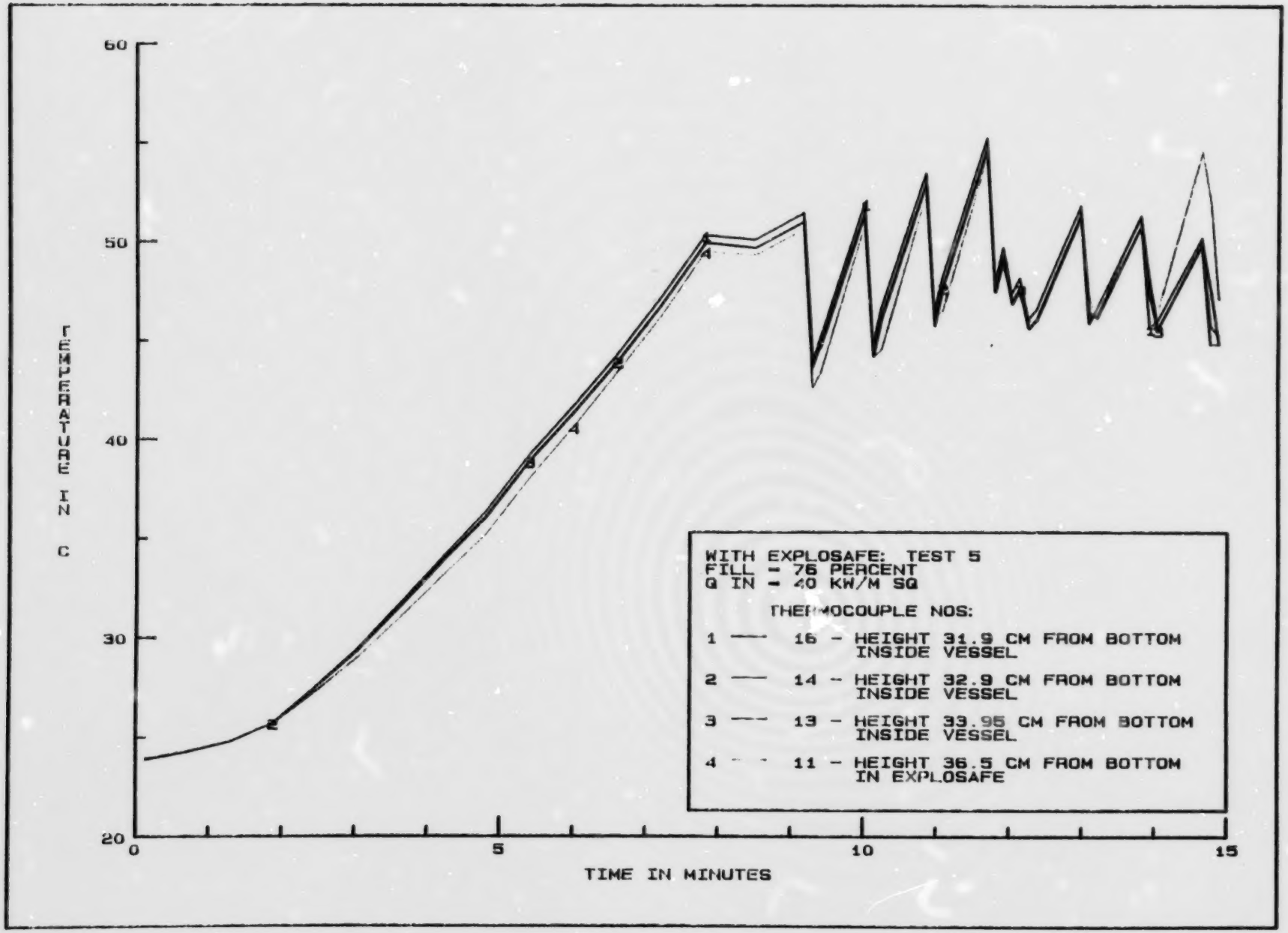
PLOTS ARE GIVEN TWO PER PAGE


WITH EXPLOSAFE: TEST 5
FILL = 76 PERCENT
Q IN = 40 KW/M SQ
THERMOCOUPLE NOS:
1 —— 34 - HEIGHT 0 CM FROM BOTTOM ON STEEL SHELL (I)
2 —— 2 - HEIGHT 2.54 CM FROM BOTTOM ON EXPLOSAFE
3 —— 8 - HEIGHT 12.15 CM FROM BOTTOM INSIDE VESSEL
4 —— 24 - HEIGHT 15.55 CM FROM BOTTOM INSIDE VESSEL
TEMPERATURE IN C
45
40
35
30
25
0
5
10
15
TIME IN MINUTES


WITH EXPLOSAFE: TEST 5
FILL = 76 PERCENT
Q IN = 40 KW/M SQ
THERMOCOUPLE NOS:
1 —— 7 - HEIGHT 17.56 CM FROM BOTTOM INSIDE VESSEL
2 — - 18 - HEIGHT 20.06 CM FROM BOTTOM INSIDE VESSEL
3 —— 19 - HEIGHT 22.6 CM FROM BOTTOM INSIDE VESSEL
4 - - 12 - HEIGHT 23.7 CM FROM BOTTOM INSIDE VESSEL
TEMPERATURE IN C
50
45
40
35
30
25
0
5
10
15
TIME IN MINUTES


TEMPERATURE IN C
50
45
40
35
30
25
0
5
10
15
TIME IN MINUTES
WITH EXPLOSAFE: TEST 5
FILL - 76 PERCENT
Q IN - 40 KW/M SQ
THERMOCOUPLE NOS:
1 —— 25 - HEIGHT 24.75 CM FROM BOTTOM INSIDE VESSEL
2 —— 22 - HEIGHT 25.8 CM FROM BOTTOM INSIDE VESSEL
3 —— 17 - HEIGHT 26.8 CM FROM BOTTOM INSIDE VESSEL
4 - - 23 - HEIGHT 28.85 CM FROM BOTTOM INSIDE VESSEL


60
50
40
30
20
TEMPERATURE IN C
0
5
10
15
TIME IN MINUTES
WITH EXPLOSAFE: TEST 5
FILL = 76 PERCENT
Q IN = 40 KW/M SQ
THERMOCOUPLE NOS:
1 —— 10 -- HEIGHT 29.9 CM FROM BOTTOM INSIDE VESSEL
2 —— 15 - HEIGHT 30.9 CM FROM BOTTOM INSIDE VESSEL
3 —— 16 - HEIGHT 31.9 CM FROM BOTTOM INSIDE VESSEL
4 —·— 14 - HEIGHT 32.9 CM FROM BOTTOM INSIDE VESSEL


60
50
40
30
20
TEMPERATURE IN C
0
5
10
15
TIME IN MINUTES
WITH EXPLOSAFE: TEST 5
FILL - 76 PERCENT
Q IN - 40 KW/M SQ
THERMOCOUPLE NOS:
1 —— 16 - HEIGHT 31.9 CM FROM BOTTOM INSIDE VESSEL
2 —— 14 - HEIGHT 32.9 CM FROM BOTTOM INSIDE VESSEL
3 —— 13 - HEIGHT 33.95 CM FROM BOTTOM INSIDE VESSEL
4 —— 11 - HEIGHT 36.5 CM FROM BOTTOM IN EXPLOSAFE

FOLLOWING ARE HEIGHT VS TEMPERATURE

PLOTS FOR THE

THERMOCOUPLES PLACED AT THE CENTRE

OF THE VESSEL

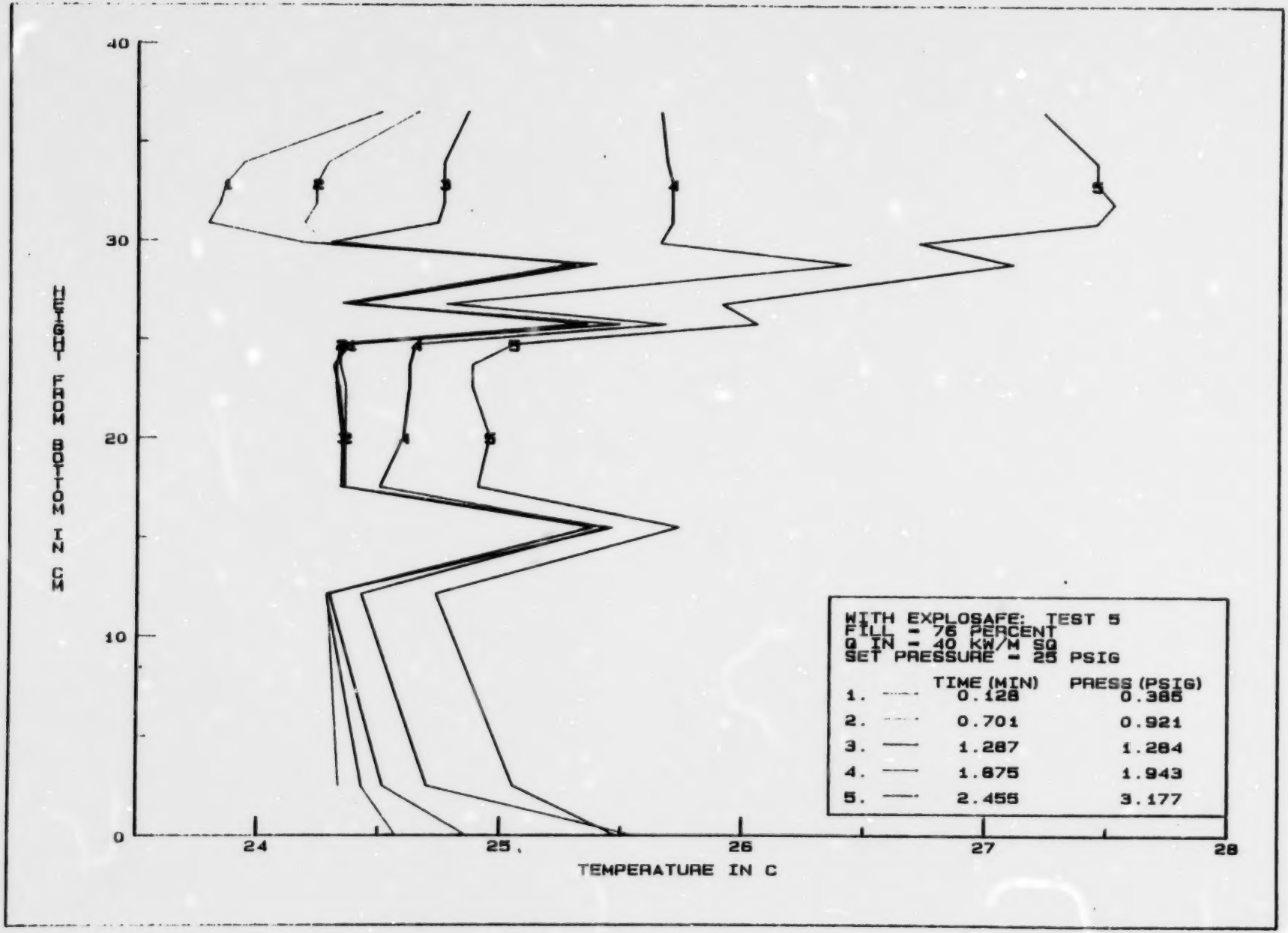
IN A VERTICAL AXIS

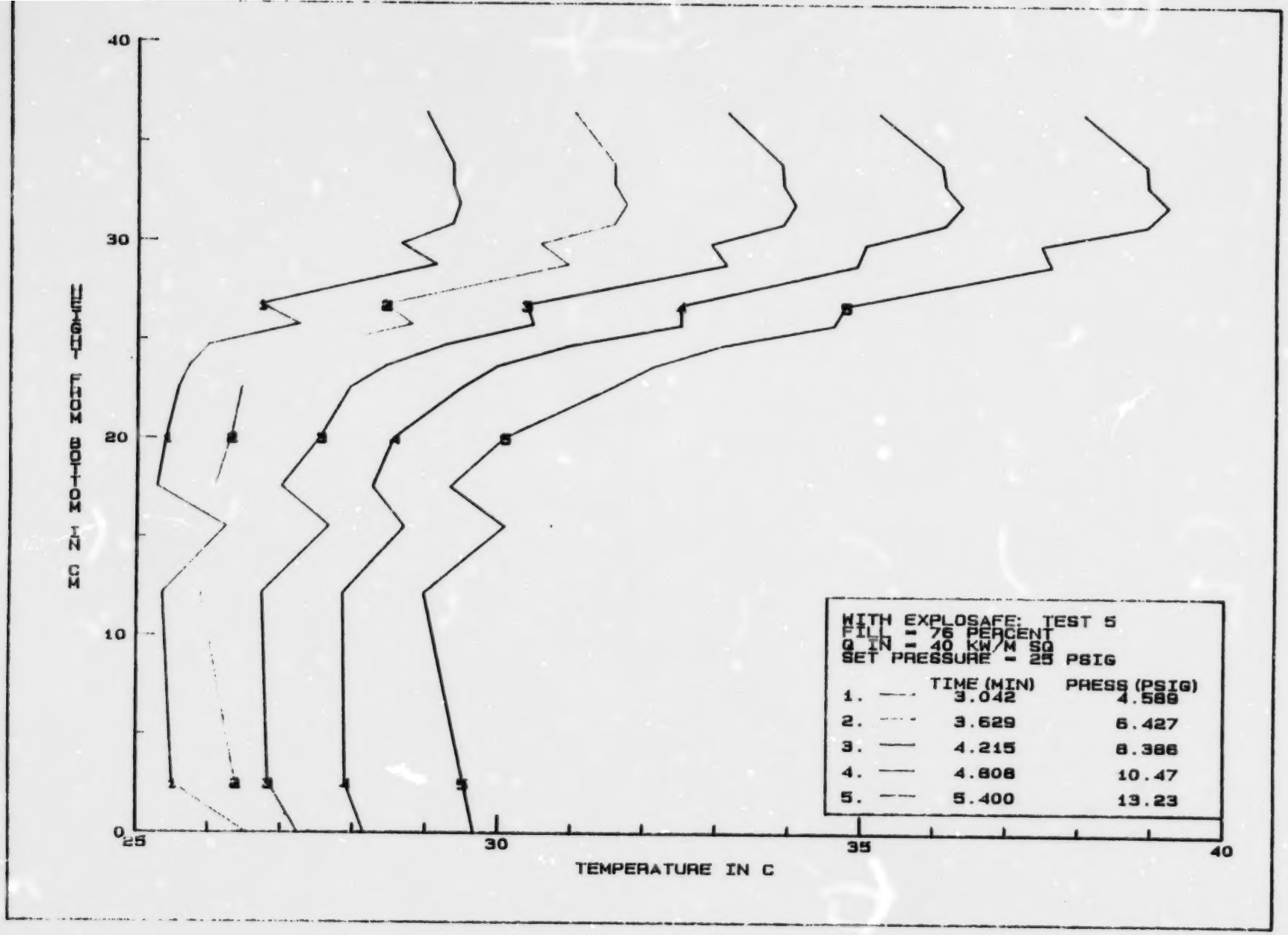
EACH PLOT REPRESENTS ONE SCAN OF

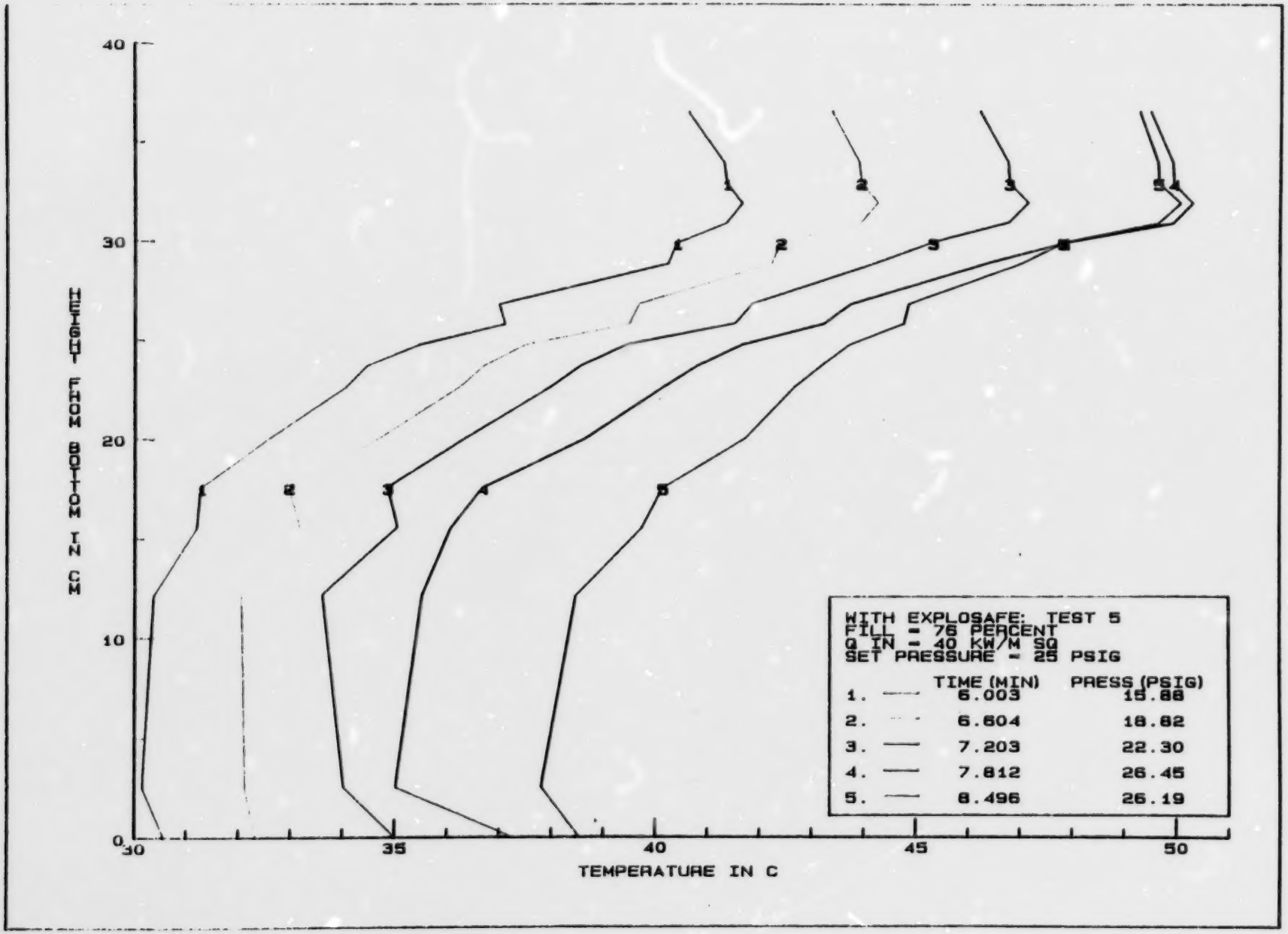
ALL THE THERMOCOUPLES

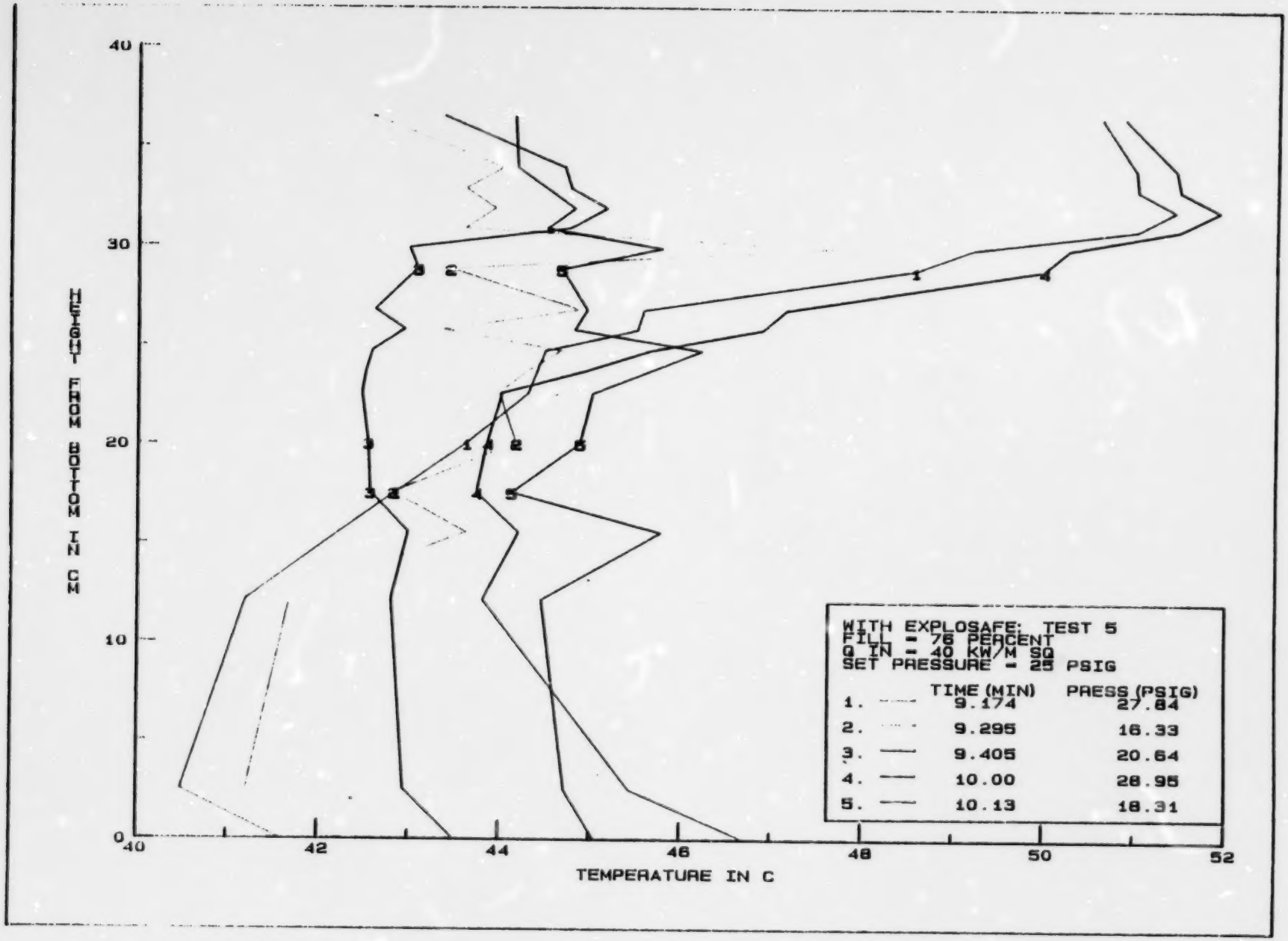
PLOTS ARE GIVEN AS FIVE (5) SCANS

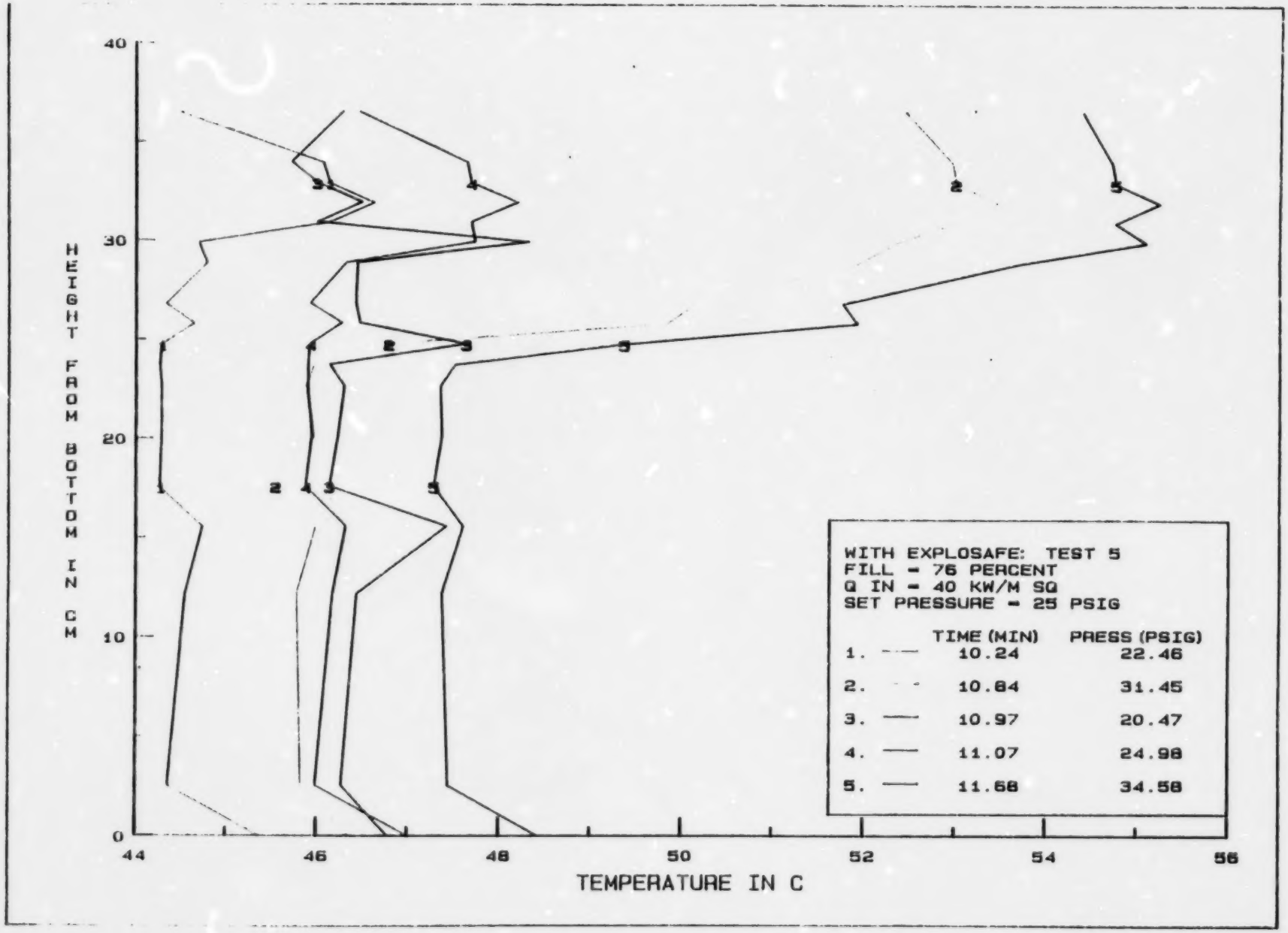
PER PAGE

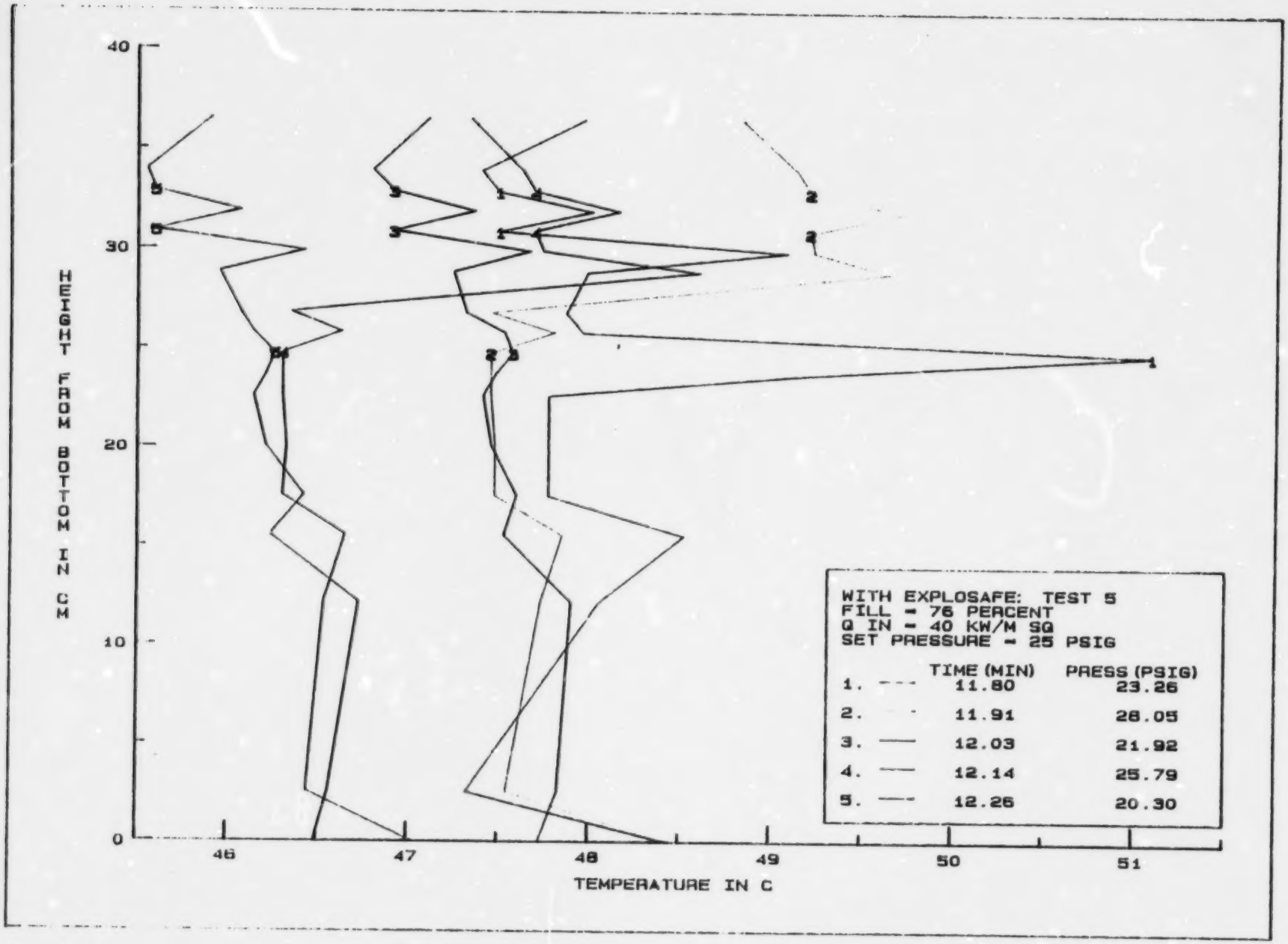

40
30
20
10
0
HEIGHT FROM BOTTOM IN CM
24
25
26
27
28
TEMPERATURE IN C
WITH EXPLOSAFE: TEST 5
FILL = 76 PERCENT
Q IN = 40 KW/M SQ
SET PRESSURE = 25 PSIG
TIME (MIN) PRESS (PSIG)
1. 0.128 0.386
2. 0.701 0.921
3. 1.287 1.284
4. 1.875 1.943
5. 2.456 3.177

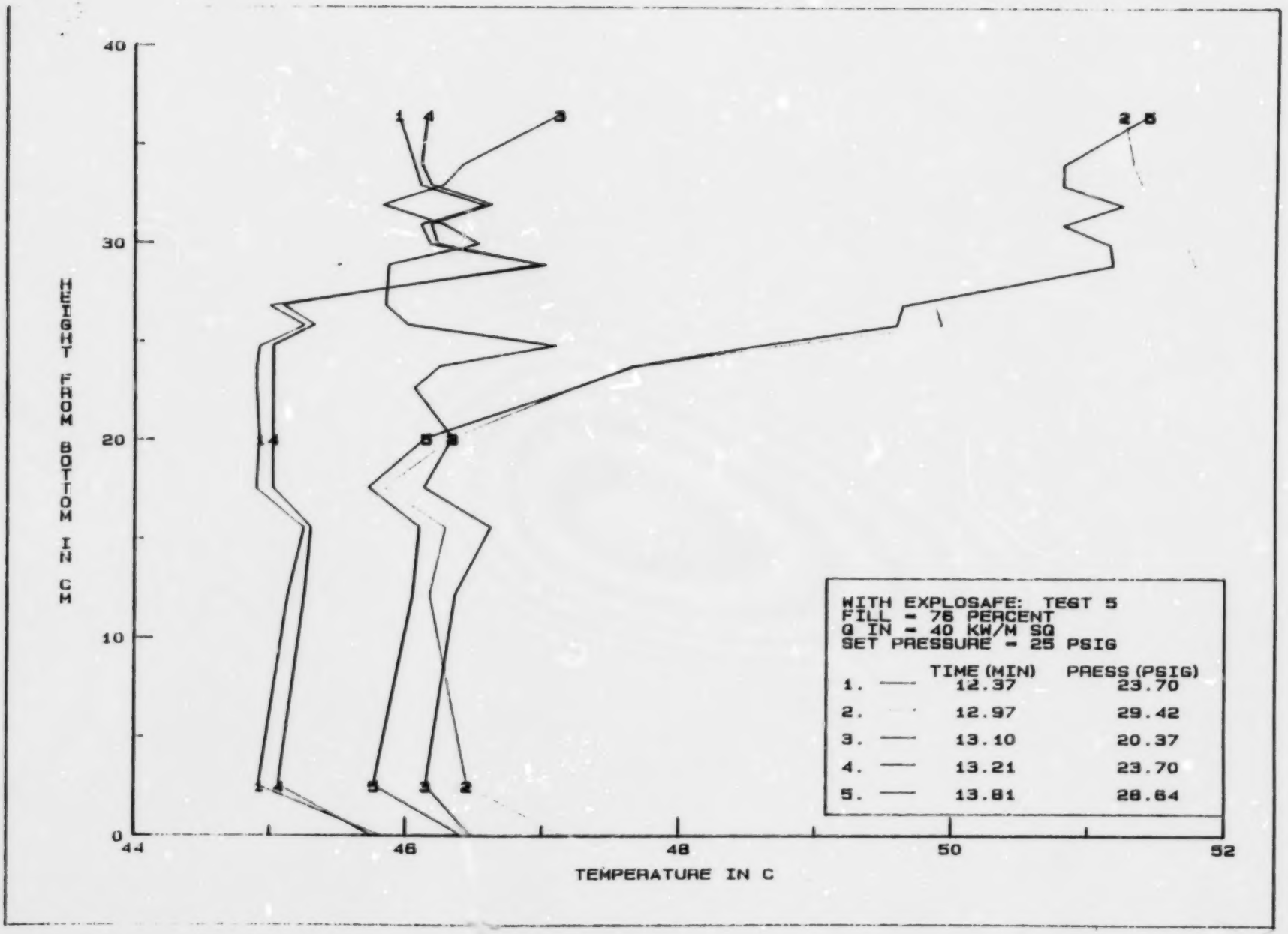

HEIGHT FROM BOTTOM IN CM
TEMPERATURE IN C
0
10
20
30
40
25
30
35
40
WITH EXPLOSAFE: TEST 5
FILL = 76 PERCENT
Q IN = 40 KW/M SQ
SET PRESSURE = 25 PSIG
TIME (MIN) PRESS (PSIG)
1. 3.042 4.588
2. 3.629 6.427
3. 4.215 8.386
4. 4.808 10.47
5. 5.400 13.23

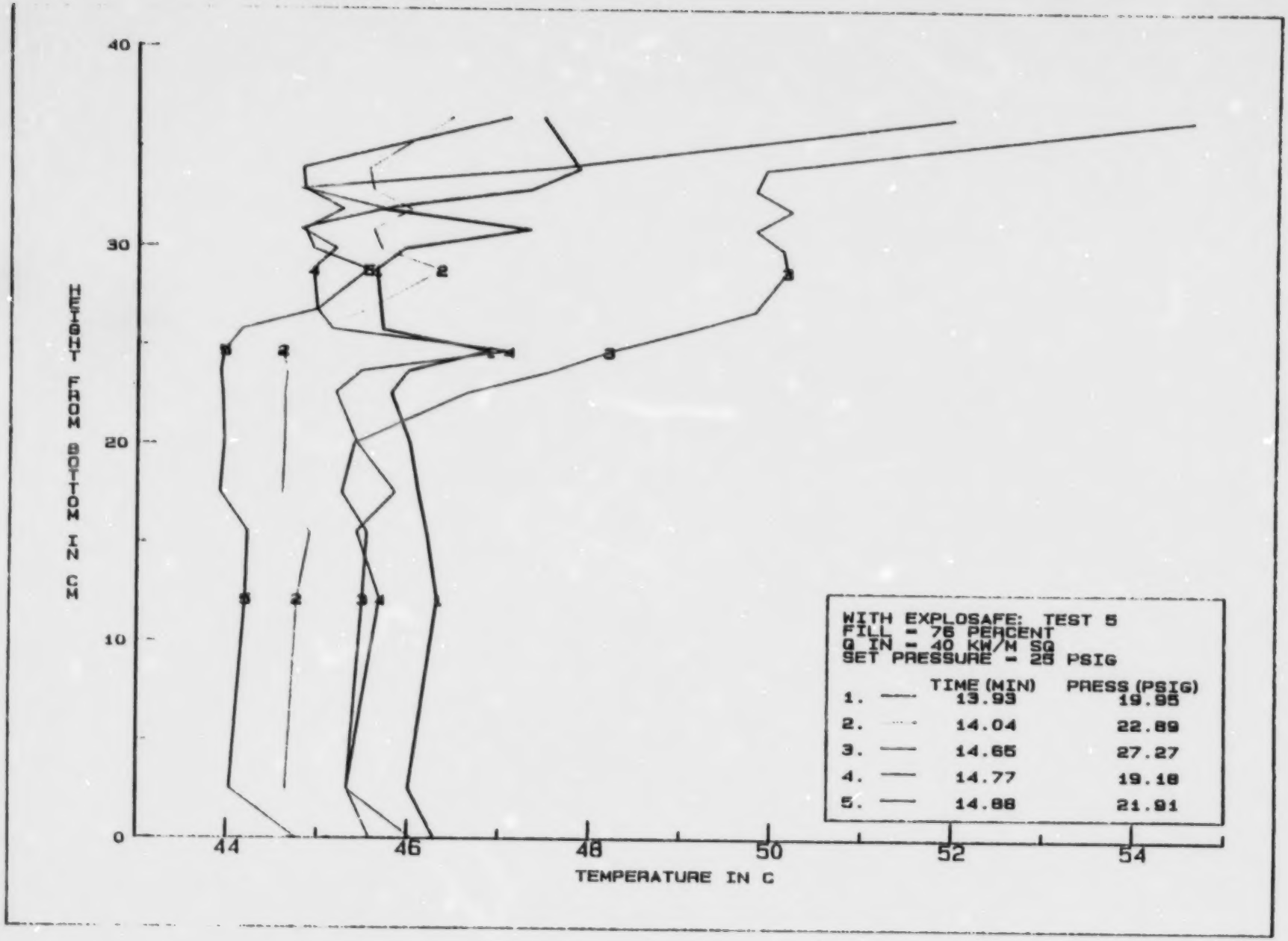

HEIGHT FROM BOTTOM IN CM
40
30
20
10
0
30
35
40
45
50
TEMPERATURE IN C
WITH EXPLOSAFE: TEST 5
FILL = 76 PERCENT
Q IN = 40 KW/M SQ
SET PRESSURE = 25 PSIG
TIME (MIN) PRESS (PSIG)
1. 6.003 15.88
2. 6.604 18.82
3. 7.203 22.30
4. 7.812 26.45
5. 8.496 26.19


HEIGHT FROM BOTTOM IN CM
0
10
20
30
40
TEMPERATURE IN C
40
42
44
46
48
50
52
WITH EXPLOSAFE: TEST 5
FILL = 76 PERCENT
Q IN = 40 KW/M SQ
SET PRESSURE = 25 PSIG
TIME (MIN) PRESS (PSIG)
1. 9.174 27.84
2. 9.295 16.33
3. 9.405 20.64
4. 10.00 28.95
5. 10.13 18.31


HEIGHT FROM BOTTOM IN CM
TEMPERATURE IN C
0
10
20
30
40
44
46
48
50
52
54
56
WITH EXPLOSAFE: TEST 5
FILL - 76 PERCENT
Q IN - 40 KW/M SQ
SET PRESSURE - 25 PSIG
TIME (MIN) PRESS (PSIG)
1. 10.24 22.46
2. 10.84 31.45
3. 10.97 20.47
4. 11.07 24.98
5. 11.68 34.58

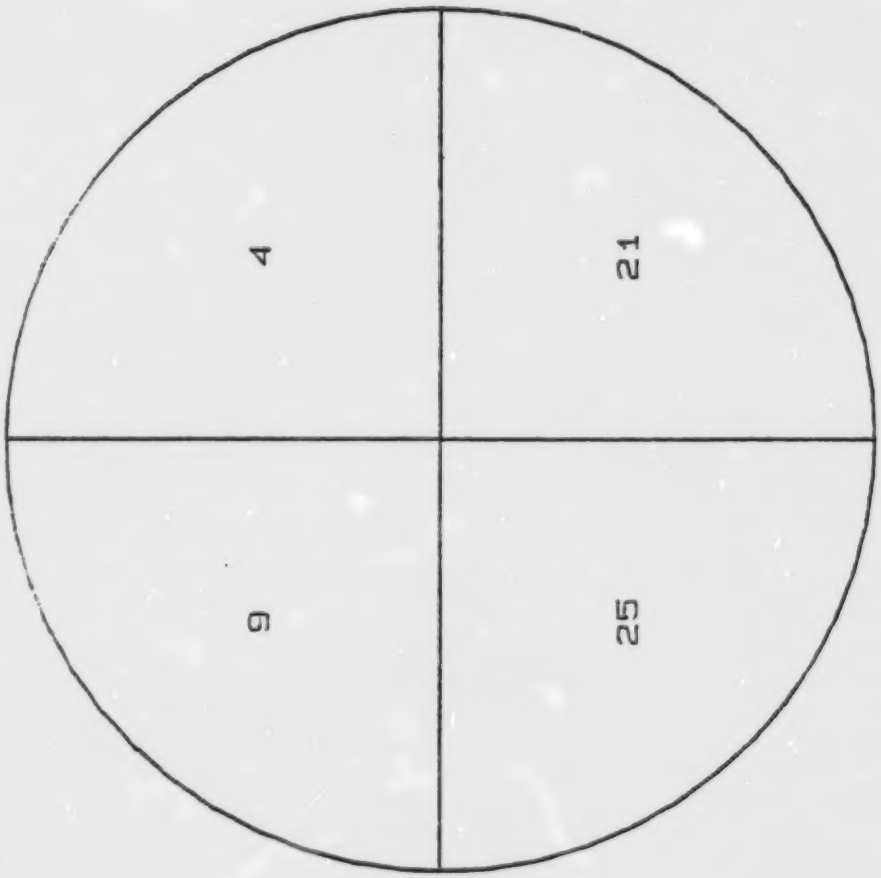

HEIGHT FROM BOTTOM IN CM
40
30
20
10
0
46
47
48
49
50
51
TEMPERATURE IN C
WITH EXPLOSAFE: TEST 5
FILL = 76 PERCENT
Q IN = 40 KW/M SQ
SET PRESSURE = 25 PSIG
TIME (MIN) PRESS (PSIG)
1. 11.80 23.26
2. 11.91 28.05
3. 12.03 21.92
4. 12.14 25.79
5. 12.26 20.30


HEIGHT FROM BOTTOM IN CM
0
10
20
30
40
44
46
48
50
52
TEMPERATURE IN C
WITH EXPLOSAFE: TEST 5
FILL = 76 PERCENT
Q IN = 40 KW/M SQ
SET PRESSURE = 25 PSIG
TIME (MIN) PRESS (PSIG)
1. 12.37 23.70
2. 12.97 29.42
3. 13.10 20.37
4. 13.21 23.70
5. 13.81 28.64


HEIGHT FROM BOTTOM IN CM
TEMPERATURE IN C
0
10
20
30
40
44
46
48
50
52
54
WITH EXPLOSAFE: TEST 5
FILL = 75 PERCENT
Q IN = 40 KW/M SQ
SET PRESSURE = 25 PSIG
TIME (MIN) PRESS (PSIG)
1. 13.93 19.95
2. 14.04 22.89
3. 14.65 27.27
4. 14.77 19.18
5. 14.88 21.91

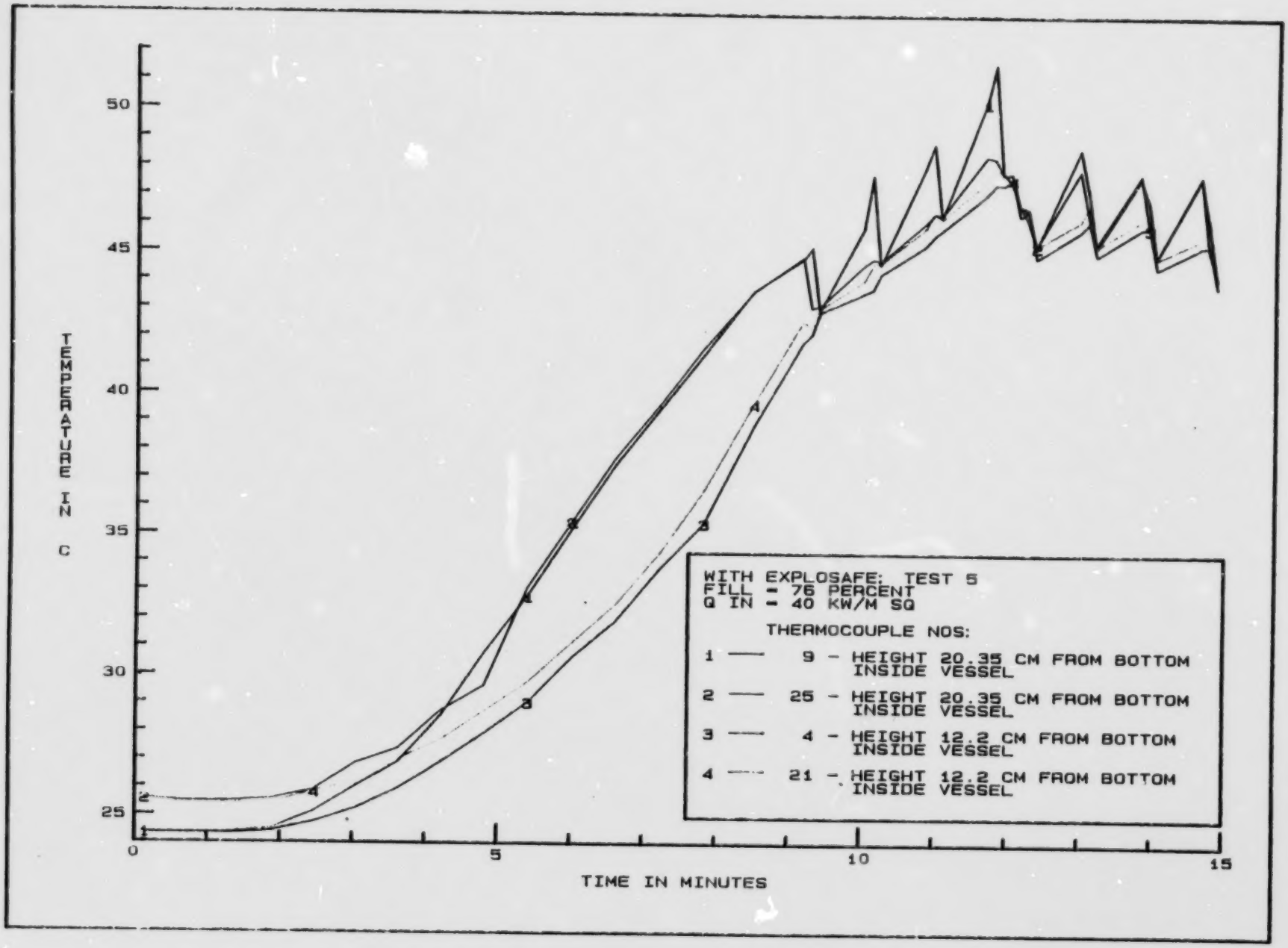
FOLLOWING FOUR THERMOCOUPLES ARE PLACED

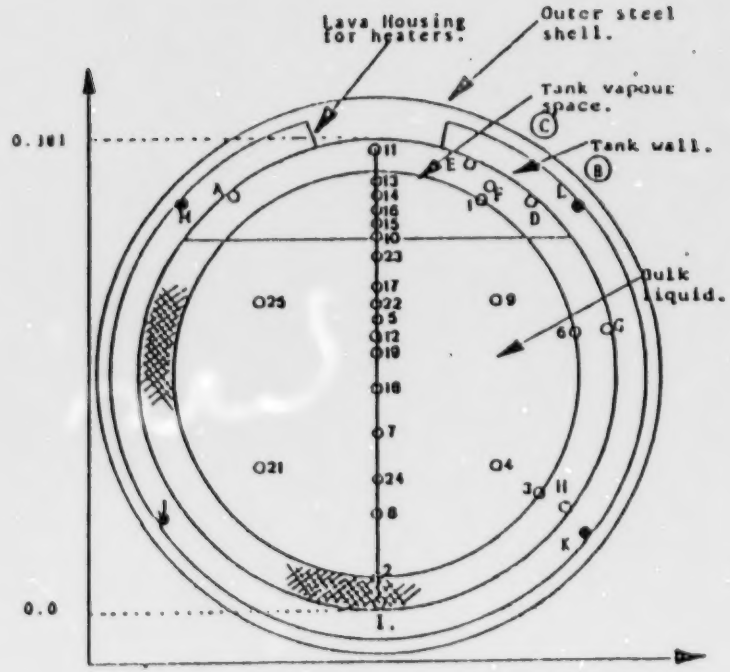
AT THE FOUR QUADRANTS ON A VERTICAL PLANE



THERMOCOUPLE NUM.	HEIGHT FROM BOTTOM IN CM
9 AND 25	20.35
4 AND 21	12.2

PLOTS ARE GIVEN _____ PER PAGE


50
45
40
35
30
25
TEMPERATURE IN C
0
5
10
15
TIME IN MINUTES
WITH EXPLOSAFE: TEST 5
FILL = 76 PERCENT
Q IN = 40 KW/M SQ
THERMOCOUPLE NOS:
1 —— 9 - HEIGHT 20.35 CM FROM BOTTOM INSIDE VESSEL
2 —— 25 - HEIGHT 20.35 CM FROM BOTTOM INSIDE VESSEL
3 —— 4 - HEIGHT 12.2 CM FROM BOTTOM INSIDE VESSEL
4 —— 21 - HEIGHT 12.2 CM FROM BOTTOM INSIDE VESSEL



SYMBOL	Thermocouple #	Angle(Deg)
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C & E	28 & 30	25 & 25
G & H	38 & 37	86 & 138
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L & M	33 & 32	50 & 295

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08	12.15	-	-
24	15.55	-	-
07	17.56	-	-
18	20.06	-	-
19	22.6	-	-
12	23.7	-	-
05	24.75	-	-
22	25.8	-	-
17	26.8	-	-
23	28.85	-	-
10	29.9.	-	-
15	30.9	-	-
16	31.9	-	-
14	32.9	-	-
13	33.95	-	-
11	36.5	-	-
1 & 35	-	42	-
6 & 3	-	86 & 138	-
9 & 25	20.35	-	-
4 & 21	12.20	-	-
30 & 28	-	25 & 25	-
29 & 27	-	55 & 55	-
26	-	308	-
38 & 37	-	86 & 138	-
36 & 31	-	135 & 220	-
32 & 33	-	295 & 50	-
20 & 40	Reference temperature	-	-

Fig. III.C A grid layout of thermocouples for an Explosafe equipped vessel. (Valid for 74, 58 and 23 percent liquid full cases)

FOLLOWING THERMOCOUPLES ARE PLACED

ON EXPLOSAFE OR

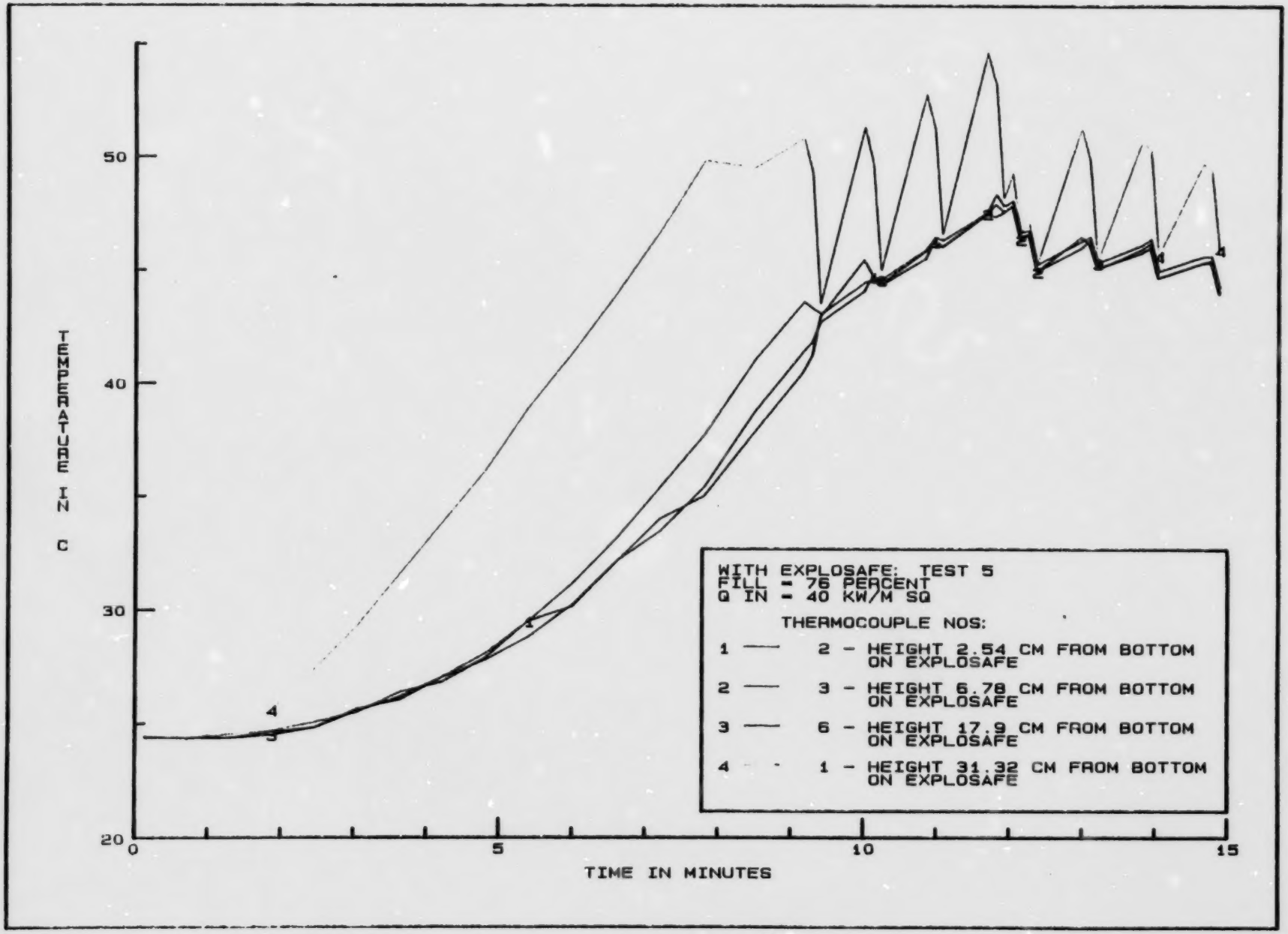
INSIDE EXPLOSAFE OR

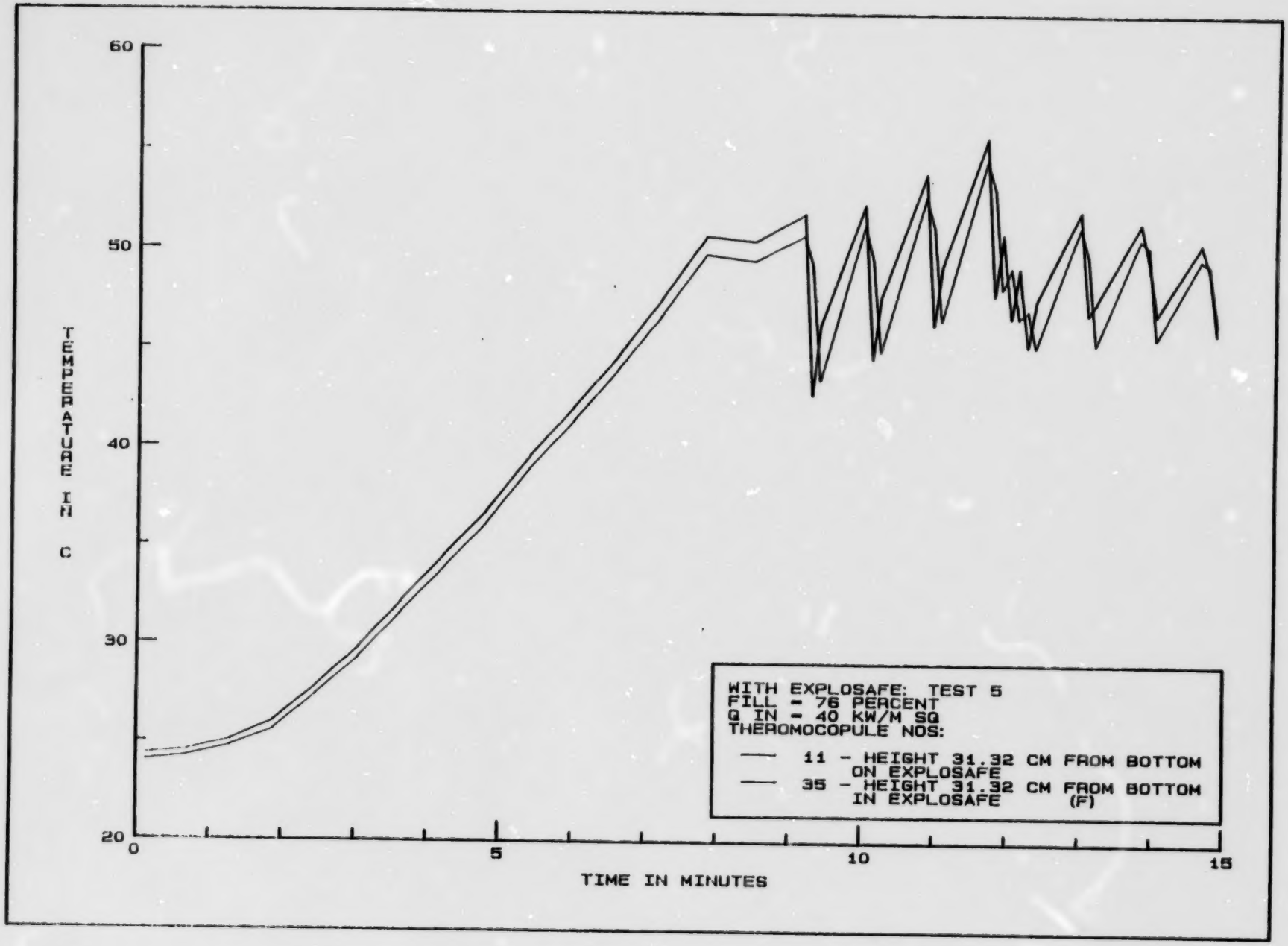
ON THE MILD STEEL SHELL OR

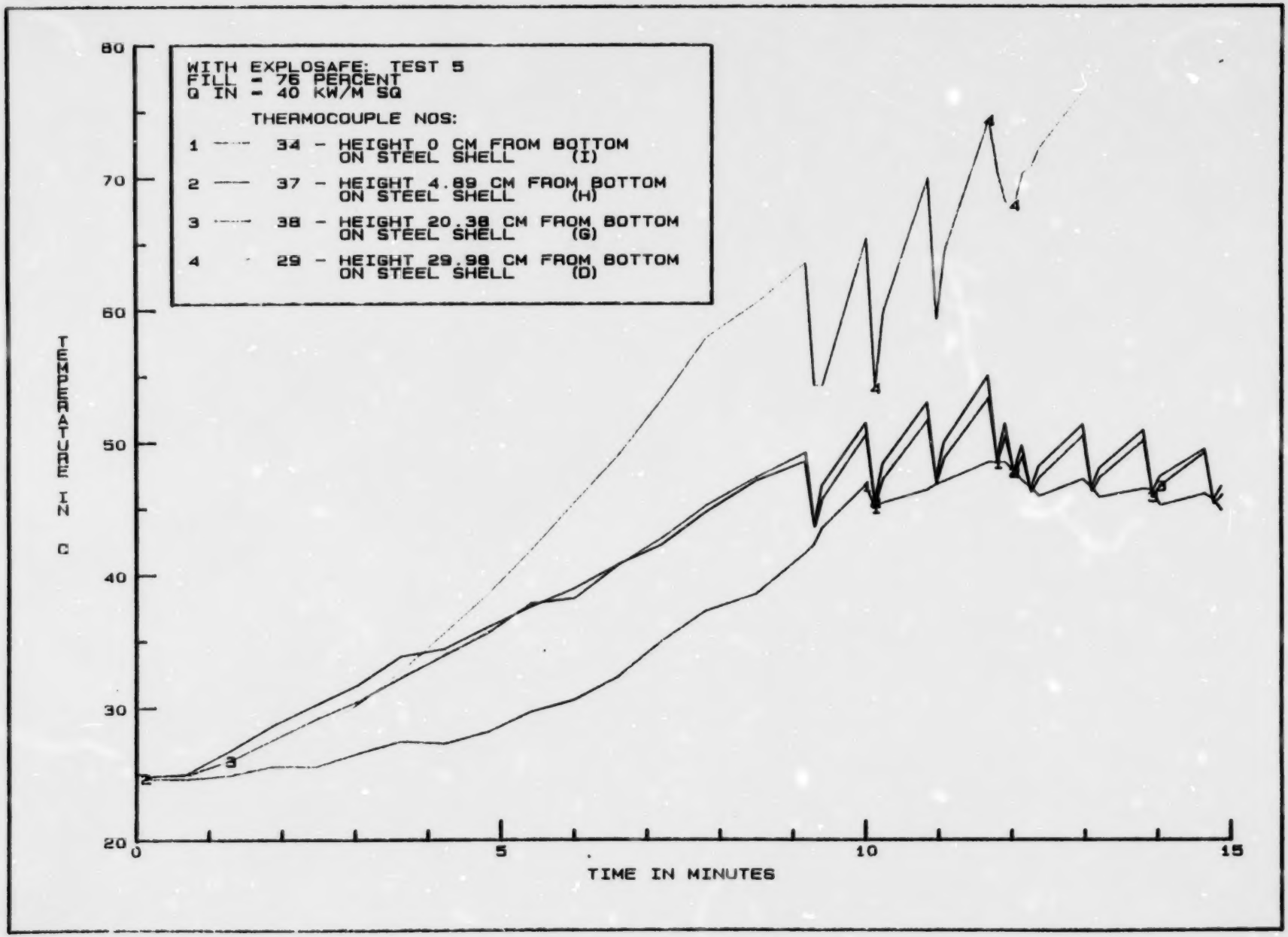
INSIDE THE MILD STEEL SHELL

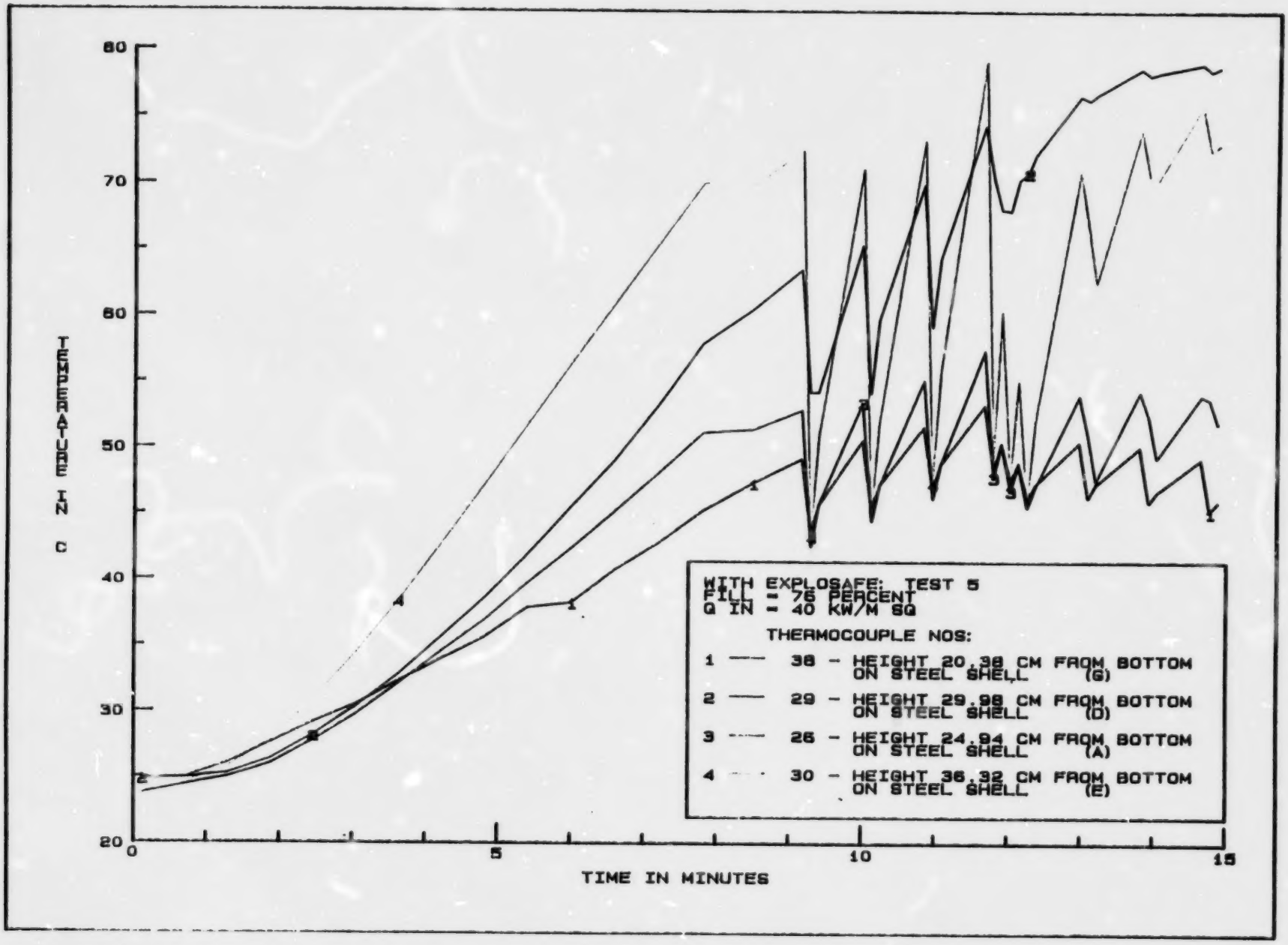
THERMOCOUPLE NUM.	HEIGHT FROM BOTTOM IN CM
ON EXPLOSAFE:	
2	2.54
3	6.78
6	17.9
1	31.32
INSIDE EXPLOSAFE:	
35 OR F	31.32
11	36.5
ON THE MILD STEEL SHELL:	
34 OR I	0
37 OR H	4.89
33 OR G	20.38
29 OR D	29.98
25 OR A	24.94
30 OR E	36.32
INSIDE THE MILD STEEL SHELL:	
27 OR B	29.98
28 OR C	36.32

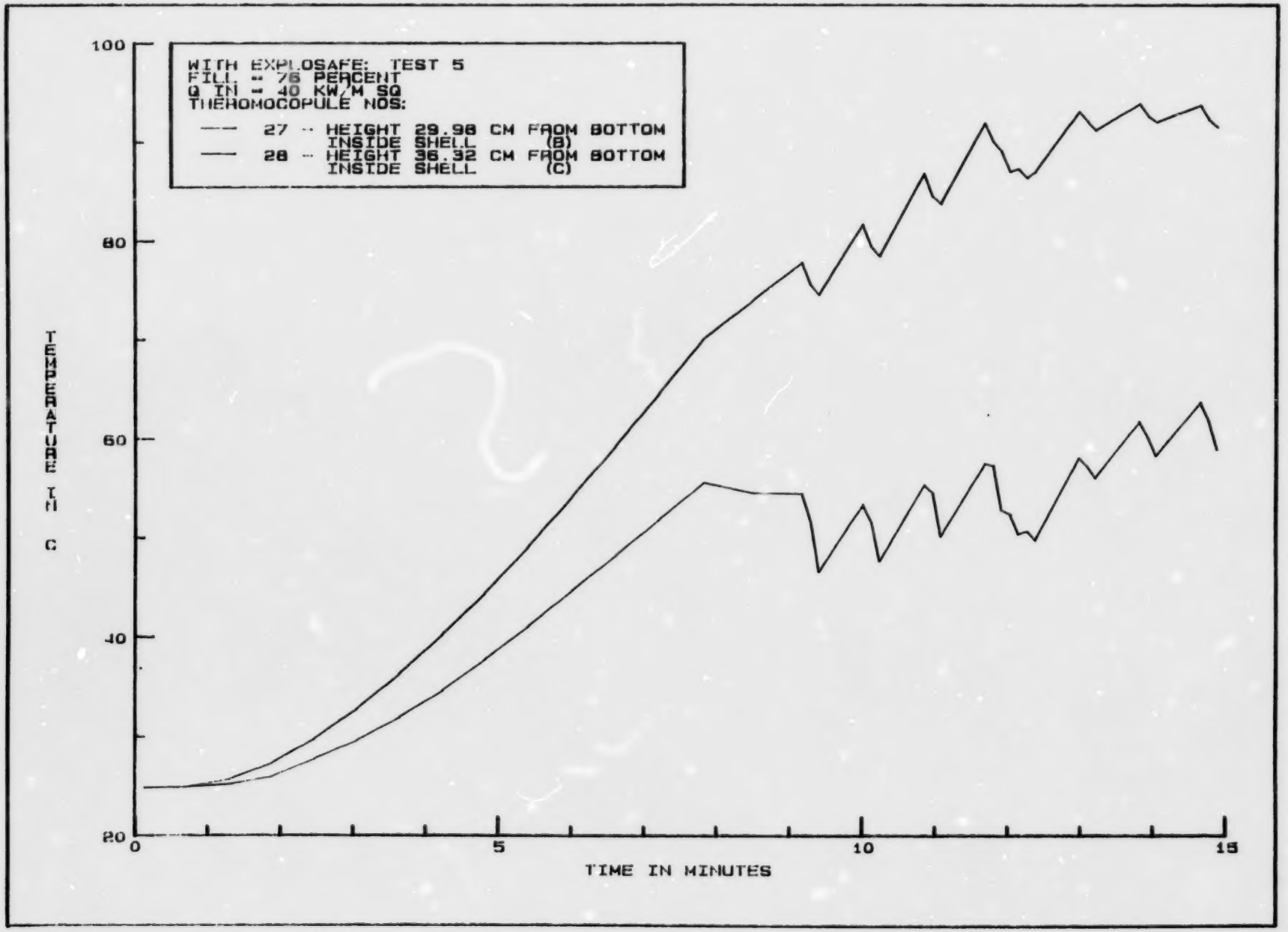
PLOTS ARE GIVEN PER PAGE


TEMPERATURE IN C
50
40
30
20
0
5
10
15
TIME IN MINUTES
WITH EXPLOSAFE: TEST 5
FILL - 76 PERCENT
Q IN - 40 KW/M SQ
THERMOCOUPLE NOS:
1 —— 2 - HEIGHT 2.54 CM FROM BOTTOM ON EXPLOSAFE
2 —— 3 - HEIGHT 6.78 CM FROM BOTTOM ON EXPLOSAFE
3 —— 6 - HEIGHT 17.9 CM FROM BOTTOM ON EXPLOSAFE
4 - - 1 - HEIGHT 31.32 CM FROM BOTTOM ON EXPLOSAFE


60
50
40
30
20
TEMPERATUAE IN C
0
5
10
15
TIME IN MINUTES
WITH EXPLOSAFE: TEST 5
FILL - 76 PERCENT
Q IN - 40 KW/M SQ
THEROMOCOPULE NOS:
11 - HEIGHT 31.32 CM FROM BOTTOM ON EXPLOSAFE
35 - HEIGHT 31.32 CM FROM BOTTOM IN EXPLOSAFE
(F)


WITH EXPLOSAFE: TEST 5
FILL = 75 PERCENT
Q IN = 40 KW/M SQ
THERMOCOUPLE NOS:
1 —— 34 - HEIGHT 0 CM FROM BOTTOM ON STEEL SHELL (I)
2 —— 37 - HEIGHT 4.89 CM FROM BOTTOM ON STEEL SHELL (H)
3 —— 38 - HEIGHT 20.38 CM FROM BOTTOM ON STEEL SHELL (G)
4 29 - HEIGHT 29.98 CM FROM BOTTOM ON STEEL SHELL (D)
TEMPERATURE IN C
80
70
60
50
40
30
20
0
5
10
15
TIME IN MINUTES


80
70
60
50
40
30
20
TEMPERATURE IN C
0
5
10
15
TIME IN MINUTES
WITH EXPLOSAFE: TEST 5
FILL = 75 PERCENT
Q IN = 40 KW/M SQ
THERMOCOUPLE NOS:
1 —— 38 - HEIGHT 20.38 CM FROM BOTTOM ON STEEL SHELL (G)
2 —— 29 - HEIGHT 29.98 CM FROM BOTTOM ON STEEL SHELL (D)
3 —— 26 - HEIGHT 24.94 CM FROM BOTTOM ON STEEL SHELL (A)
4 —— 30 - HEIGHT 36.32 CM FROM BOTTOM ON STEEL SHELL (E)

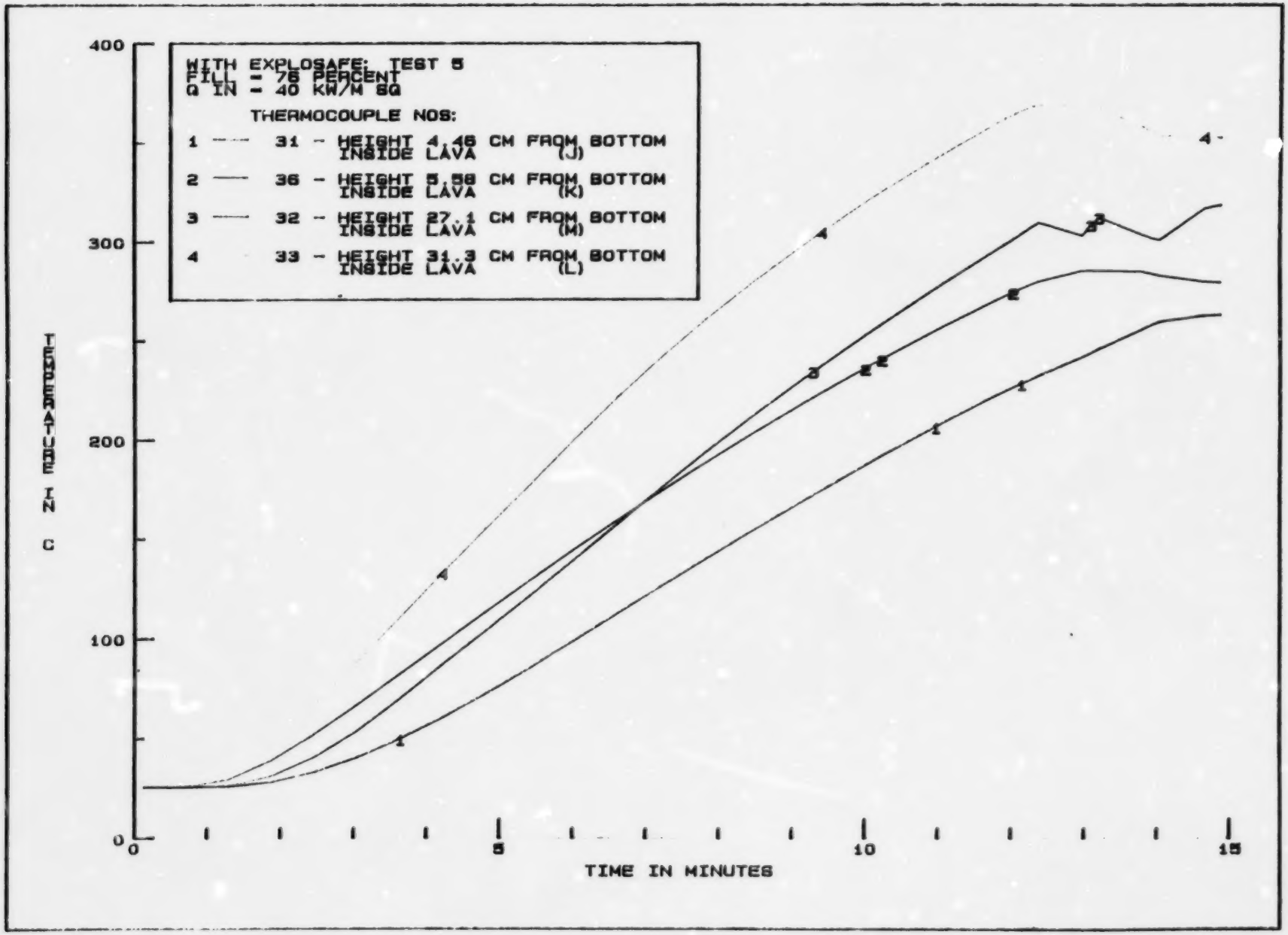

WITH EXPLOSAFE: TEST 5
FILL = 76 PERCENT
Q IN = 40 KW/M SQ
THERMOCOPULE NOS:
27 -- HEIGHT 29.98 CM FROM BOTTOM INSIDE SHELL (B)
28 -- HEIGHT 36.32 CM FROM BOTTOM INSIDE SHELL (C)
100
80
60
40
20
TEMPERATURE IN C
0
5
10
15
TIME IN MINUTES

FOLLOWING THERMOCOUPLES ARE PLACED

IN THE LAVA MEDIUM

THERMOCOUPLE NUM.	HEIGHT FROM BOTTOM IN CM
30 OR K	5.58
31 OR J	4.46
32 OR M	27.1
33 OR L	31.3

ALL FOUR PLOTS ARE GIVEN IN ONE PAGE


WITH EXPLOSAFE: TEST 5
FILL = 76 PERCENT
Q IN = 40 KW/M SQ
THERMOCOUPLE NOS:
1 —— 31 - HEIGHT 4.46 CM FROM BOTTOM INSIDE LAVA (J)
2 —— 36 - HEIGHT 5.58 CM FROM BOTTOM INSIDE LAVA (K)
3 —— 32 - HEIGHT 27.1 CM FROM BOTTOM INSIDE LAVA (M)
4 33 - HEIGHT 31.3 CM FROM BOTTOM INSIDE LAVA (L)
400
300
200
100
0
TEMPERATURE IN C
0
5
10
15
TIME IN MINUTES

TEST 5

WITH EXPLOSAFE

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITH EXPLOSAFE - FILE NAME : TEST 5 (UNBT25)

DATE OF TEST : AUG 17, 1983 Q IN = 40 KW/M SQ LIQUID LEVEL = 75 PERCENT

SET PRESSURE = 25 PSIG PRV ORIFICE DIAMETER = 3/8 INCHES

	TIME MINS	PRESSURE PSIG	THRM#1 C	THRM#2 C	THRM#3 C	THRM#4 C	THRM#5 C	THRM#6 C	THRM#7 C	THRM#8 C	THRM#9 C	THRM#10 C	THRM#11 C
1.	0.129	0.385	23.987	24.431	24.381	24.307	24.381	24.357	24.357	24.283	24.357	24.184	24.504
2.	0.702	0.921	24.239	24.337	24.337	24.313	24.337	24.362	24.337	24.288	24.337	24.263	24.657
3.	1.288	1.284	24.764	24.518	24.370	24.296	24.345	24.370	24.345	24.296	24.370	24.296	24.862
4.	1.875	1.943	25.607	24.698	24.673	24.403	24.649	24.526	24.501	24.427	24.501	25.656	25.656
5.	2.456	3.177	27.406	25.051	24.830	24.732	25.051	24.830	24.904	24.732	25.100	26.720	27.234
6.	3.042	4.590	29.296	25.504	25.675	25.233	25.995	25.577	25.282	25.356	26.019	28.637	28.979
7.	3.629	6.427	31.593	26.375	26.056	25.958	27.674	26.178	26.080	25.884	26.089	30.549	31.011
8.	4.216	8.387	33.853	26.826	27.046	26.899	29.245	27.071	26.997	26.728	28.537	32.911	33.128
9.	4.808	10.470	36.130	27.891	27.817	27.915	30.961	28.111	28.257	27.842	30.766	35.047	35.216
10.	5.401	13.234	38.921	29.513	28.831	29.026	33.056	29.538	29.318	28.953	32.790	37.461	38.036
11.	6.003	15.880	41.341	30.160	30.257	30.622	35.458	31.205	31.278	30.379	35.145	40.413	40.628
12.	6.604	18.823	43.939	32.116	32.165	31.922	37.813	33.181	32.963	32.043	37.465	42.400	43.371
13.	7.203	22.302	46.711	34.015	33.484	33.774	39.462	35.437	34.859	33.605	39.415	45.321	46.217
14.	7.812	26.451	49.822	35.021	35.430	35.406	41.670	37.735	36.680	35.527	41.385	47.855	49.495
15.	8.497	26.199	49.486	37.797	38.706	38.874	43.724	41.019	40.138	38.467	43.676	47.823	49.275
16.	9.174	27.841	50.834	40.489	41.417	41.845	44.497	43.599	42.841	41.203	44.804	49.199	50.624
17.	9.295	16.338	49.272	41.206	41.848	42.156	44.666	43.271	42.820	41.582	45.208	47.679	42.583
18.	9.405	20.643	43.487	42.943	42.706	42.919	42.587	43.038	42.564	42.801	42.967	42.990	43.369
19.	10.009	28.958	51.346	45.440	44.071	43.598	48.652	44.449	43.740	43.811	45.888	50.273	50.879
20.	10.130	18.315	49.621	44.711	44.782	43.743	46.220	44.617	44.121	44.452	47.748	48.773	44.144
21.	10.241	22.469	44.950	44.360	44.336	44.289	44.289	44.573	44.266	44.549	44.596	44.691	44.502
22.	10.849	31.459	52.788	46.817	46.510	46.298	48.781	46.911	46.534	46.769	48.049	52.346	52.439
23.	10.970	20.476	51.231	46.266	46.289	46.654	47.629	46.431	46.125	46.431	48.871	48.309	46.266
24.	11.080	24.982	46.552	46.987	46.011	46.869	46.917	46.293	46.869	46.176	46.270	47.727	46.458
25.	11.684	34.586	54.642	47.439	47.509	47.110	49.361	47.533	47.275	47.368	50.342	55.105	54.388
26.	11.806	23.268	53.162	47.324	47.911	47.465	51.091	48.333	47.770	48.052	51.650	49.083	47.958
27.	11.916	28.059	48.150	47.540	47.563	47.422	47.446	47.798	47.469	47.727	47.798	49.227	48.829
28.	12.037	21.922	49.255	47.826	47.849	47.662	47.568	48.061	47.591	47.896	47.849	47.662	47.098
29.	12.147	25.792	46.677	46.442	46.371	46.324	46.301	46.653	46.301	46.536	46.677	47.734	47.335
30.	12.268	20.303	47.080	46.563	46.587	46.540	46.257	46.751	46.422	46.728	46.587	46.422	45.904
31.	12.377	23.703	45.201	44.918	44.941	44.847	44.918	45.248	44.894	45.130	45.225	46.167	45.932
32.	12.979	29.421	51.315	46.445	45.974	45.833	48.699	46.280	45.833	46.163	48.699	51.711	51.245
33.	13.101	20.375	49.802	46.143	46.308	46.167	47.084	46.473	46.120	46.355	47.178	46.520	47.107
34.	13.210	23.703	45.369	45.062	45.038	44.944	46.015	45.321	45.015	45.251	45.227	46.217	46.146
35.	13.815	28.645	50.734	45.764	45.929	45.929	48.560	46.117	45.717	46.047	47.716	51.153	51.433
36.	13.936	19.957	50.271	46.003	46.215	45.956	46.874	46.380	46.098	46.309	46.827	45.933	47.461
37.	14.046	22.894	45.554	44.640	44.663	44.498	44.592	44.946	44.592	44.758	44.876	45.577	46.454
38.	14.654	27.277	49.710	45.320	45.343	45.296	48.188	45.626	45.249	45.485	47.719	50.107	54.618
39.	14.775	19.180	49.410	45.323	45.441	45.323	47.089	45.630	45.842	45.677	46.101	45.182	51.976
40.	14.885	21.916	45.940	44.029	43.958	43.863	43.958	44.241	43.910	44.194	44.194	44.926	47.093

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITH EXPLOSAFE - FILE NAME : TEST 5 (UNBT25)

DATE OF TEST : AUG 17, 1983 Q IN = 40 KW/M SQ LIQUID LEVEL = 76 PERCENT

SET PRESSURE = 25 PSIG PRV ORIFICE DIAMETER = 3/8 INCHES

	TIME MINS	PRESSURE PSIG	THRM#12 C	THRM#13 C	THRM#14 C	THRM#15 C	THRM#16 C	THRM#17 C	THRM#18 C	THRM#19 C	THRM#20 C	THRM#21 C	THRM#22 C
1.	0.129	0.385	24.307	23.930	23.864	23.790	23.839	24.381	24.357	24.332	2.811	25.439	25.488
2.	0.702	0.921	24.337	24.288	24.239	24.189	24.239	24.362	24.362	24.362	2.811	25.395	25.346
3.	1.288	1.284	24.321	24.764	24.764	24.739	24.764	24.345	24.345	24.321	2.812	25.403	25.354
4.	1.875	1.943	24.624	25.681	25.705	25.705	25.705	24.772	24.599	24.624	2 [illegible]	25.386	25.681
5.	2.456	3.177	24.879	27.455	27.455	27.455	27.528	25.911	24.953	24.879	2.814	25.813	26.058
6.	3.042	4.590	25.725	29.344	29.344	29.344	29.442	26.706	25.405	25.577	2.815	26.191	27.244
7.	3.629	6.427	26.816	31.569	31.569	31.569	31.738	28.430	26.301	26.448	2.816	26.987	28.796
8.	4.216	8.387	28.440	33.877	33.901	33.901	34.070	30.364	27.535	27.951	2.817	27.682	30.462
9.	4.808	10.470	29.964	36.082	36.130	36.130	36.370	32.488	28.550	29.477	2.818	28.697	32.512
10.	5.401	13.234	32.113	38.897	38.921	38.921	39.207	34.770	30.073	31.531	2.820	29.732	34.602
11.	6.003	15.880	34.471	41.318	41.365	41.365	41.674	36.996	32.611	34.061	2.821	31.132	37.116
12.	6.604	18.823	36.721	43.892	43.939	43.939	44.270	39.688	34.726	36.241	2.822	32.504	39.497
13.	7.203	22.302	38.579	46.758	46.781	46.781	47.157	41.867	36.374	37.981	2.824	34.329	41.534
14.	7.812	26.451	40.814	49.916	49.939	49.939	50.313	43.756	38.668	40.148	2.825	36.560	43.236
15.	8.497	26.199	43.179	49.626	49.649	49.649	50.070	44.858	41.732	42.658	2.827	39.662	44.763
16.	9.174	27.841	44.403	50.997	51.021	51.021	51.440	45.583	43.623	44.308	2.829	42.604	45.512
17.	9.295	16.338	44.288	44.028	43.602	43.602	43.933	44.878	44.170	43.980	2.829	42.346	43.365
18.	9.405	20.643	42.516	44.693	44.764	44.764	45.165	42.611	42.540	42.469	2.830	43.061	42.943
19.	10.009	28.958	44.921	51.439	51.485	51.485	51.928	47.158	43.858	44.023	2.831	44.047	46.899
20.	10.130	18.315	45.631	44.168	44.499	44.499	44.806	44.947	44.877	45.018	2.831	44.617	44.806
21.	10.241	22.469	44.266	46.058	46.129	46.129	46.623	44.336	44.289	44.289	2.832	44.691	44.644
22.	10.849	31.469	45.958	52.950	52.997	52.997	53.461	50.156	45.958	45.864	2.833	45.911	49.829
23.	10.970	20.476	46.126	45.701	45.983	45.983	46.478	46.407	46.219	46.289	2.834	46.454	46.454
24.	11.080	24.982	45.893	47.633	47.680	47.680	48.196	45.917	45.940	45.893	2.834	46.246	46.270
25.	11.684	34.586	47.509	54.712	54.758	54.758	55.244	51.764	47.368	47.345	2.836	47.603	51.927
26.	11.806	23.268	49.176	47.395	47.489	47.489	48.005	47.864	47.770	47.770	2.836	48.028	47.958
27.	11.916	28.059	47.446	49.133	49.204	49.204	49.718	47.446	47.469	47.446	2.837	47.845	47.798
28.	12.037	21.922	47.474	46.793	46.910	46.910	47.357	47.310	47.450	47.403	2.837	47.638	47.521
29.	12.147	25.792	46.301	47.617	47.687	47.687	48.156	46.348	46.324	46.301	2.837	46.677	46.630
30.	12.268	20.303	46.210	45.551	45.598	45.598	46.069	46.069	46.210	46.140	2.838	46.422	46.140
31.	12.377	23.703	44.894	46.049	46.096	46.096	46.567	44.989	44.918	44.894	2.838	45.272	45.248
32.	12.979	29.421	47.667	51.315	51.385	51.385	51.804	49.868	46.328	47.221	2.840	46.186	49.915
33.	13.101	20.375	46.237	46.402	46.261	46.261	46.813	45.837	46.331	46.049	2.840	46.731	46.002
34.	13.210	23.703	45.015	46.099	46.170	46.170	46.617	45.086	45.015	45.015	2.841	45.274	45.321
35.	13.815	28.645	47.645	50.804	50.804	50.804	51.247	49.636	46.141	47.222	2.843	46.235	49.589
36.	13.936	19.957	45.980	47.860	47.320	47.320	45.550	45.674	46.003	45.791	2.843	46.239	45.697
37.	14.046	22.894	44.640	45.536	45.583	45.583	46.007	45.512	44.616	44.616	2.844	44.852	44.946
38.	14.654	27.277	47.531	49.920	49.803	49.803	50.200	49.803	45.390	46.615	2.845	45.579	49.055
39.	14.775	19.180	45.465	47.535	44.781	44.781	45.724	44.970	45.418	45.182	2.846	45.394	45.135
40.	14.885	21.916	43.910	44.808	44.832	44.832	45.257	44.973	43.958	43.934	2.846	44.123	44.147

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITH EXPLOSAFE - FILE NAME : TEST 5 (UNBT25)

DATE OF TEST : AUG 17, 1983 Q IN = 40 KW/M SQ LIQUID LEVEL = 76 PERCENT

SET PRESSURE = 25 PSIG PRV ORIFICE DIAMETER = 3/8 INCHES

	TIME MINS	PRESSURE PSIG	THRM#23 C	THRM#24 C	THRM#25 C	THRM#26 C	THRM#27 C	THRM#28 C	THRM#29 C	THRM#30 C	THRM#31 C	THRM#32 C	THRM#33 C
1.	0.129	0.365	25.380	25.463	25.562	23.765	24.809	24.809	24.848	24.036	25.447	25.369	25.563
2.	0.702	0.921	25.346	25.395	25.444	24.422	24.944	24.886	24.906	24.597	25.428	25.428	28.071
3.	1.288	1.284	25.304	25.378	25.476	26.004	25.178	25.680	25.255	25.776	25.757	26.317	35.544
4.	1.875	1.943	26.441	25.435	25.558	26.028	25.989	27.320	26.356	27.841	28.053	31.248	49.365
5.	2.456	3.177	27.112	25.739	25.886	27.798	27.759	29.762	28.164	30.878	33.009	40.697	67.556
6.	3.042	4.590	28.125	26.240	26.853	29.776	29.622	32.774	30.315	34.443	40.444	53.912	88.527
7.	3.629	6.427	30.938	26.791	27.379	32.133	31.960	36.235	32.747	38.414	49.764	70.011	110.660
8.	4.216	8.387	33.128	27.658	28.732	34.580	34.619	40.162	35.595	42.734	60.619	87.291	133.150
9.	4.808	10.470	34.927	28.697	29.623	36.944	37.747	44.360	38.511	47.189	72.495	104.110	155.260
10.	5.401	13.234	37.605	30.073	33.105	39.778	41.094	49.035	41.837	51.797	85.215	121.330	177.010
11.	6.003	15.880	40.247	31.205	35.434	42.416	44.699	54.110	45.478	56.457	98.814	139.300	199.490
12.	6.604	18.823	42.234	33.181	37.728	45.255	48.234	59.201	49.048	61.006	112.530	157.600	221.160
13.	7.203	22.302	44.235	35.052	39.605	48.162	51.872	64.518	53.251	65.568	126.240	175.700	241.350
14.	7.812	26.451	46.352	36.080	41.647	51.214	55.575	70.022	57.911	70.097	139.840	193.610	260.400
15.	8.497	26.199	47.024	39.733	43.653	51.467	54.489	73.947	60.495	69.899	155.020	212.820	280.220
16.	9.174	27.841	48.567	42.225	44.875	52.945	54.417	77.805	63.540	72.572	169.420	230.980	298.490
17.	9.295	16.330	43.436	43.626	43.057	42.542	51.572	75.466	54.197	43.342	172.010	234.170	301.640
18.	9.405	20.643	43.085	42.990	43.156	45.858	46.522	74.450	54.243	50.974	174.370	236.970	304.450
19.	10.009	28.958	49.992	44.212	44.590	53.525	58.393	81.664	65.371	71.205	186.980	252.420	319.850
20.	10.130	18.315	44.664	45.773	44.806	44.479	51.473	79.294	54.118	44.916	189.590	255.440	322.750
21.	10.241	22.469	44.785	44.758	44.739	47.257	47.599	78.372	59.756	52.180	191.850	258.160	325.290
22.	10.849	31.459	51.927	45.981	46.099	55.217	55.330	86.810	69.929	73.307	203.860	273.020	339.080
23.	10.970	20.476	46.431	47.418	46.431	46.181	54.488	84.409	59.179	47.415	206.250	275.930	341.700
24.	11.080	24.982	46.317	46.317	46.387	48.863	50.112	83.657	64.368	55.892	208.450	278.510	344.100
25.	11.684	34.586	53.716	47.603	48.448	57.452	57.489	91.942	74.362	79.199	219.850	292.690	357.010
26.	11.806	23.268	47.982	48.521	48.357	47.881	57.251	89.917	70.339	49.321	221.980	295.460	359.500
27.	11.916	28.059	49.648	47.845	47.868	50.426	52.751	88.999	68.029	60.418	223.950	298.000	361.780
28.	12.037	21.922	47.239	47.521	47.521	46.870	52.284	86.916	67.922	47.723	226.020	300.880	363.980
29.	12.147	25.792	48.602	46.653	46.724	48.791	50.325	87.255	70.303	55.217	227.890	303.570	365.810
30.	12.268	20.303	45.951	46.234	46.187	45.536	50.672	86.299	70.851	45.764	229.910	306.600	367.630
31.	12.377	23.703	47.014	45.248	45.295	47.136	49.732	86.952	72.256	52.228	231.790	309.210	368.960
32.	12.979	29.421	51.781	46.280	47.972	54.057	58.090	93.085	76.557	70.947	241.180	302.440	368.110
33.	13.101	20.375	45.861	46.614	46.331	51.003	57.155	92.002	76.228	66.692	243.330	308.030	367.680
34.	13.210	23.703	46.969	45.298	45.392	47.582	56.032	91.123	76.719	62.519	245.320	311.800	367.180
35.	13.815	28.645	51.177	46.094	47.833	54.347	61.744	93.904	78.628	74.106	255.380	302.760	357.450
36.	13.936	19.957	45.626	46.192	46.003	52.467	60.117	92.528	78.097	70.476	257.590	301.100	354.740
37.	14.046	22.894	46.337	44.899	44.923	49.295	58.261	91.961	78.326	70.314	259.160	300.390	353.120
38.	14.654	27.277	50.154	45.532	47.813	54.071	63.721	93.745	79.007	75.976	262.310	316.490	352.790
39.	14.775	19.180	44.922	45.418	45.182	53.719	61.787	92.200	78.437	72.516	262.530	317.680	352.480
40.	14.885	21.916	45.539	44.218	44.218	51.930	58.944	91.449	78.759	72.969	262.670	318.360	352.020

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITH EXPLOSAFE - FILE NAME : TEST 5 (UNBT25)

DATE OF TEST : AUG 17, 1983 Q IN = 40 KW/M SQ LIQUID LEVEL = 76 PERCENT

SET PRESSURE = 25 PSIG PRV ORIFICE DIAMETER = 3/8 INCHES

	TIME MINS	PRESSURE PSIG	THRM#34 C	THRM#35 C	THRM#36 C	THRM#37 C	THRM#38 C	THRM#39 C	THRM#40 C
1.	0.129	0.385	24.577	24.326	25.254	24.770	24.809	*******	2.718
2.	0.702	0.921	24.558	24.538	25.486	25.080	24.964	*******	2.724
3.	1.288	1.284	24.868	25.081	29.112	26.780	26.047	*******	2.730
4.	1.875	1.943	25.564	26.047	38.680	28.689	27.610	*******	2.736
5.	2.456	3.177	25.482	27.836	51.669	30.205	29.146	*******	2.741
6.	3.042	4.590	26.539	29.796	66.429	31.737	30.527	*******	2.747
7.	3.629	6.427	27.438	32.152	81.888	33.860	32.286	*******	2.752
8.	4.216	8.387	27.237	34.484	97.353	34.427	33.948	*******	2.757
9.	4.808	10.470	28.153	36.753	112.990	36.046	35.605	*******	2.761
10.	5.401	13.234	29.662	39.549	128.500	37.601	37.869	*******	2.766
11.	6.003	15.880	30.575	42.055	144.000	39.004	38.259	*******	2.771
12.	6.604	18.823	32.328	44.628	159.050	40.822	40.783	*******	2.775
13.	7.203	22.302	34.998	47.556	173.670	42.293	42.826	*******	2.779
14.	7.812	26.451	37.279	50.741	187.900	44.750	45.263	-0.125	2.783
15.	8.497	26.199	38.528	50.483	203.460	47.092	47.377	*******	2.788
16.	9.174	27.841	41.603	51.925	218.230	48.556	49.219	*******	2.792
17.	9.295	16.338	42.257	42.714	220.810	43.760	43.551	*******	2.793
18.	9.405	20.643	43.502	46.333	223.120	46.769	45.763	*******	2.794
19.	10.009	28.958	46.731	52.410	235.580	51.465	50.633	0.241	2.798
20.	10.130	18.315	45.049	44.555	238.040	45.505	45.277	*******	2.798
21.	10.241	22.469	45.379	47.750	240.150	48.395	47.238	*******	2.799
22.	10.849	31.459	46.345	53.953	252.050	52.990	51.649	*******	2.803
23.	10.370	20.476	46.770	46.295	254.330	47.206	46.940	*******	2.804
24.	11.080	24.982	47.005	49.317	256.390	49.999	48.825	*******	2.804
25.	11.684	34.586	48.424	55.775	267.530	55.002	53.304	*******	2.808
26.	11.806	23.268	48.430	47.805	269.700	48.734	48.506	-0.114	2.809
27.	11.916	28.059	48.437	50.917	271.650	51.390	50.426	*******	2.809
28.	12.037	21.922	47.723	46.680	273.730	47.761	47.477	*******	2.810
29.	12.147	25.792	47.020	49.227	275.560	49.738	48.924	*******	2.811
30.	12.268	20.303	46.485	45.251	277.480	46.447	46.162	*******	2.811
31.	12.377	23.703	45.826	47.572	279.070	48.160	47.307	*******	2.812
32.	12.979	29.421	47.151	52.131	284.550	51.318	50.485	*******	2.815
33.	13.101	20.375	46.475	46.874	284.670	46.551	46.229	*******	2.816
34.	13.210	23.703	45.742	47.525	284.580	48.018	47.317	*******	2.817
35.	13.815	28.645	46.419	51.533	283.940	50.890	50.133	*******	2.820
36.	13.936	19.957	46.294	49.441	283.010	46.218	45.895	*******	2.821
37.	14.046	22.894	45.141	46.888	282.120	47.419	46.717	*******	2.821
38.	14.654	27.277	46.047	50.500	279.100	49.478	49.232	*******	2.825
39.	14.775	19.180	45.578	49.105	278.890	45.559	45.274	*******	2.825
40.	14.885	21.916	44.767	46.419	278.660	46.628	45.963	*******	2.826

PLOTS OF A TEST

CARRIED OUT ON THE UNB TANK 2

WITH EXPLOSAFE

TEST NUMBER 6

Q in = 40 kW/m sq

LIQUID LEVEL = 74 %

SET PRESSURE = 25 psig

PRV ORIFICE DIAMETER = 3/8 in.

Date of Test AUG/DEC - 1983

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Thermocouple Grid Layout - - - - - - - - - - - - - 3

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   (a) Plots of Temperature Vs Time - - - - - - - 4

   (b) Plots of Height Vs. Temperature - - - - - - 10

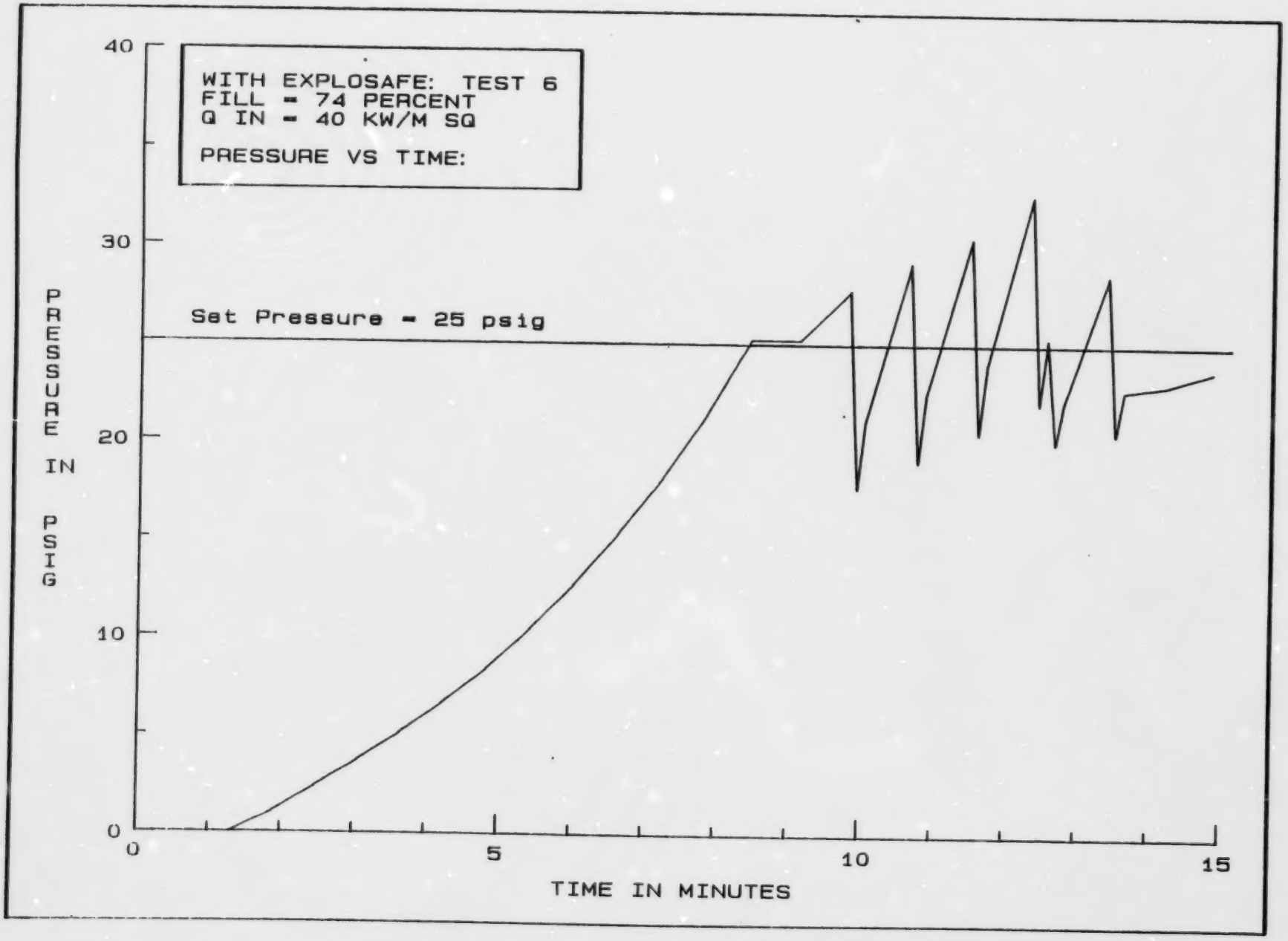
2. Thermocouples Placed in the Four Quadrants in a Vertical Plane: Temp. Vs. Time - - - - - 18

Thermocouple Grid Layout - - - - - - - - - - - - 20

3. Thermocouples Placed On and Inside the Mild Steel Shell: Temp. Vs. Time - - - - - - 21

4. Thermocouples Placed in the Lava Medium Temp. Vs. Time - - - - - - - - - - - - - - - 26

6. Print out of Data - - - - - - - - - - - - - 29


WITH EXPLOSAFE: TEST 6
FILL = 74 PERCENT
Q IN = 40 KW/M SQ
PRESSURE VS TIME:
Set Pressure = 25 psig
PRESSURE IN PSIG
TIME IN MINUTES
0
10
20
30
40
0
5
10
15

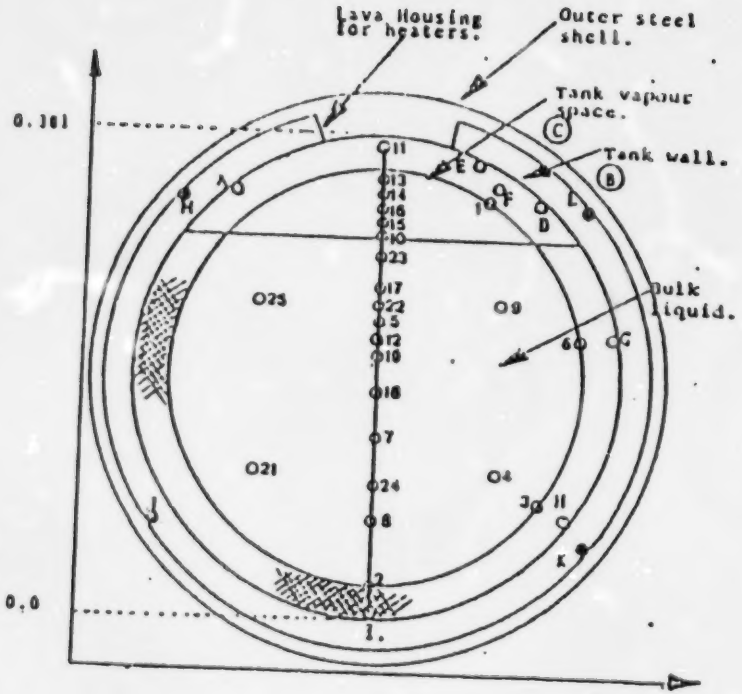
FOLLOWING THERMOCOUPLES ARE PLACED

AT THE CENTRE OF THE VESSEL (DIA. 38.1 CM)

IN A VERTICLE AXIS

THERMOCOUPLE NUM.	HEIGHT FROM BOTTOM IN CM
34 CR I	0
2	2.54
8	12.15
24	15.55
7	17.56
19	20.06
15	22.6
12	23.7
5	24.75
22	25.9
17	26.8
23	28.85
10	29.9
15	30.9
16	31.9
14	32.9
13	33.95
11	36.5

PLOTS ARE GIVEN TWO PER PAGE



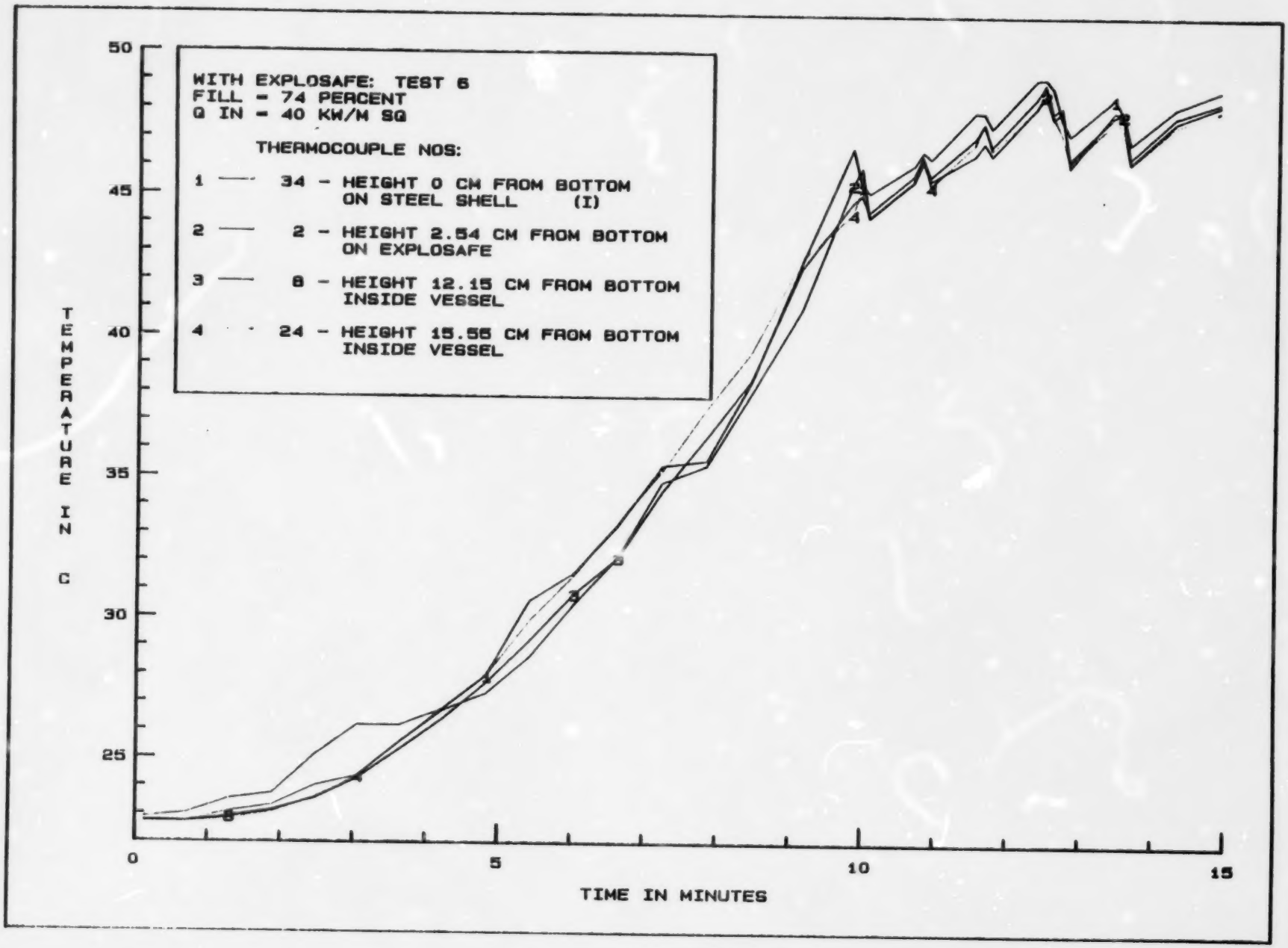
SYMBOL	Thermocouple #	Angle(Deg)
A	26	308
B & D	27 & 29	55 & 55
C & E	28 & 30	25 & 25
G & H	38 & 37	86 & 138
I	34	180
J & K	31 & 36	220 & 135
L & M	33 & 32	50 & 295

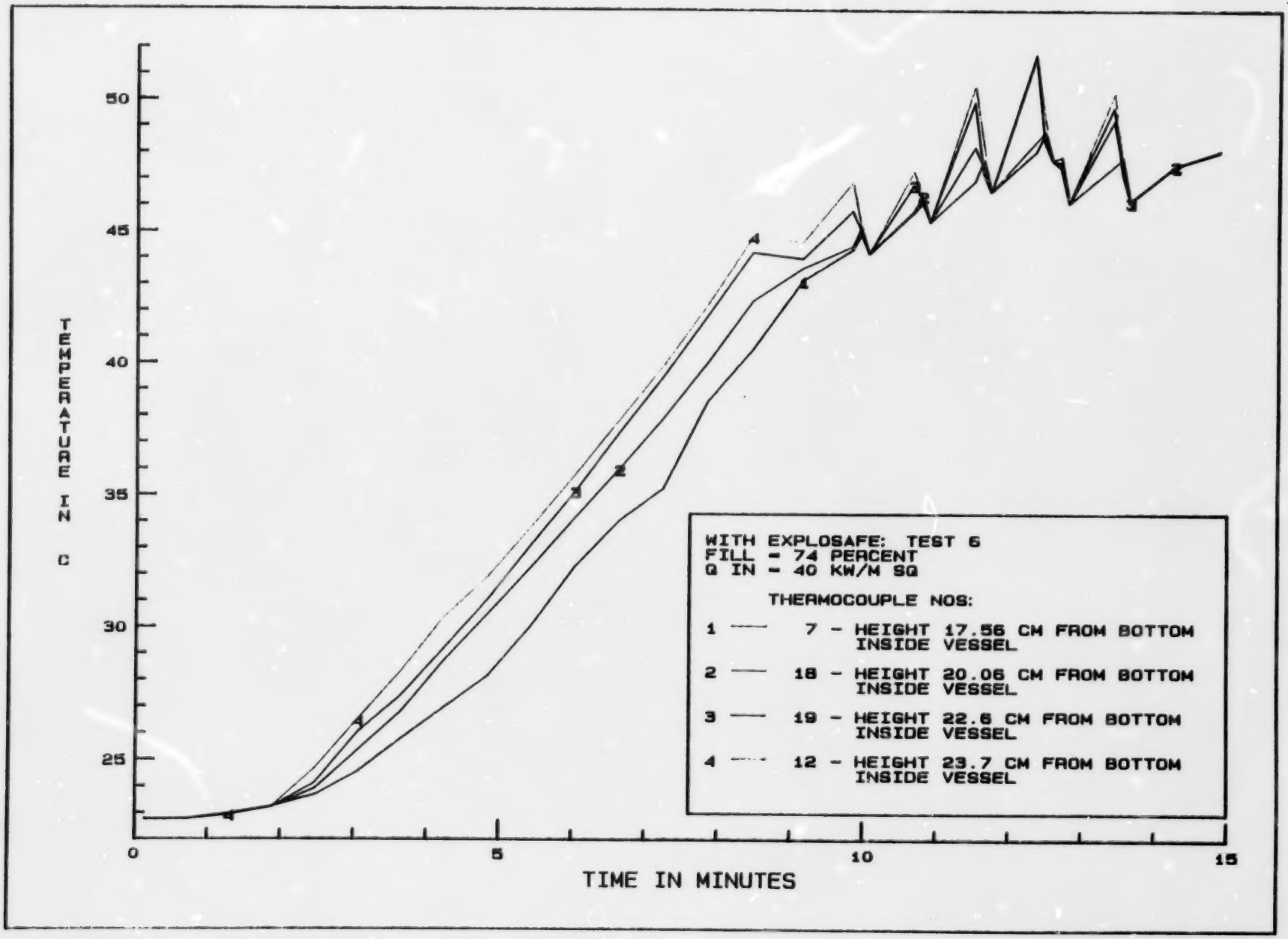
Circled thermocouples are ½ the depth of the tank back from thermocouples D & E

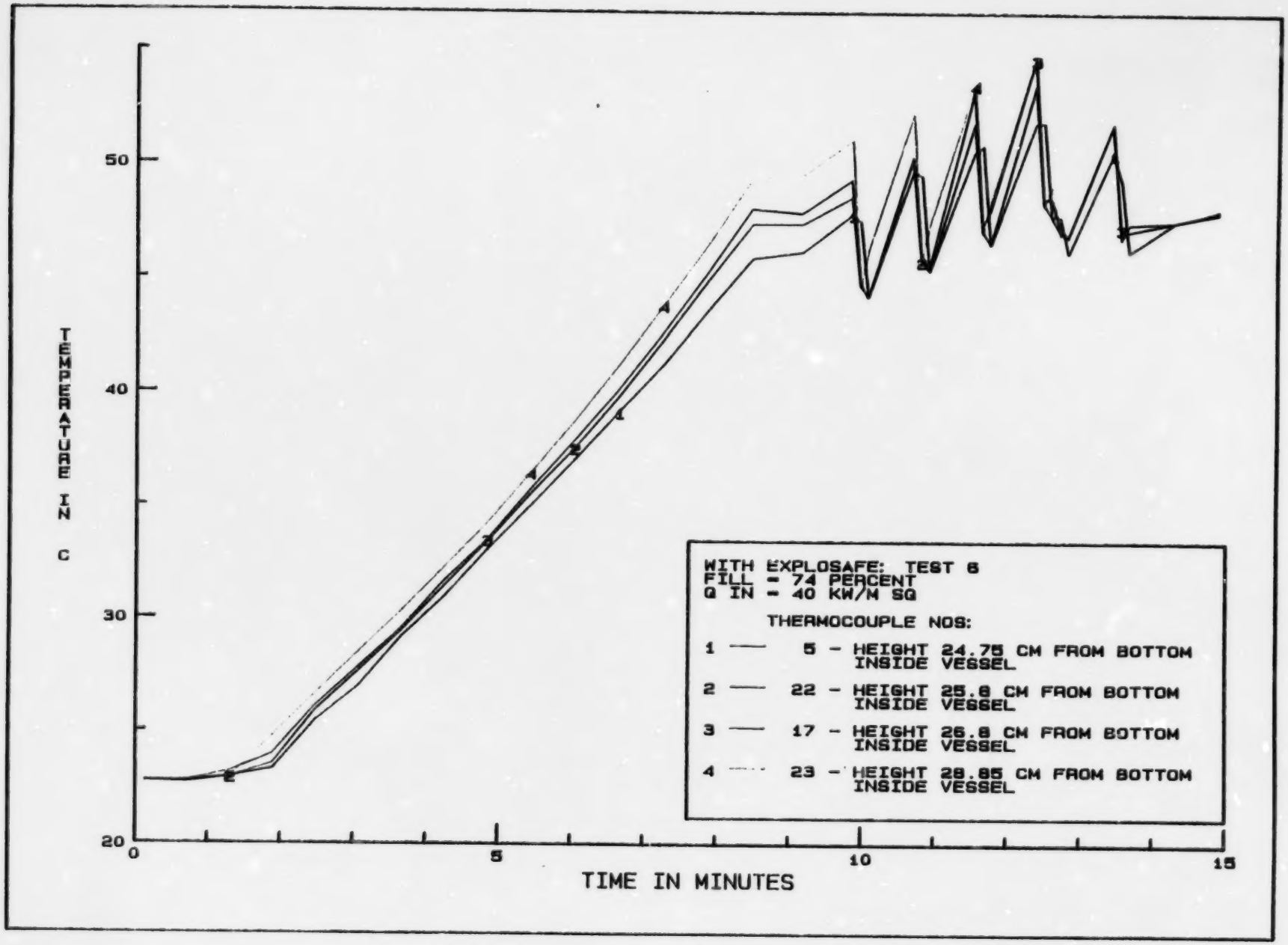
Number 41 represents pressure in psig.
Number 42 represents time in seconds.

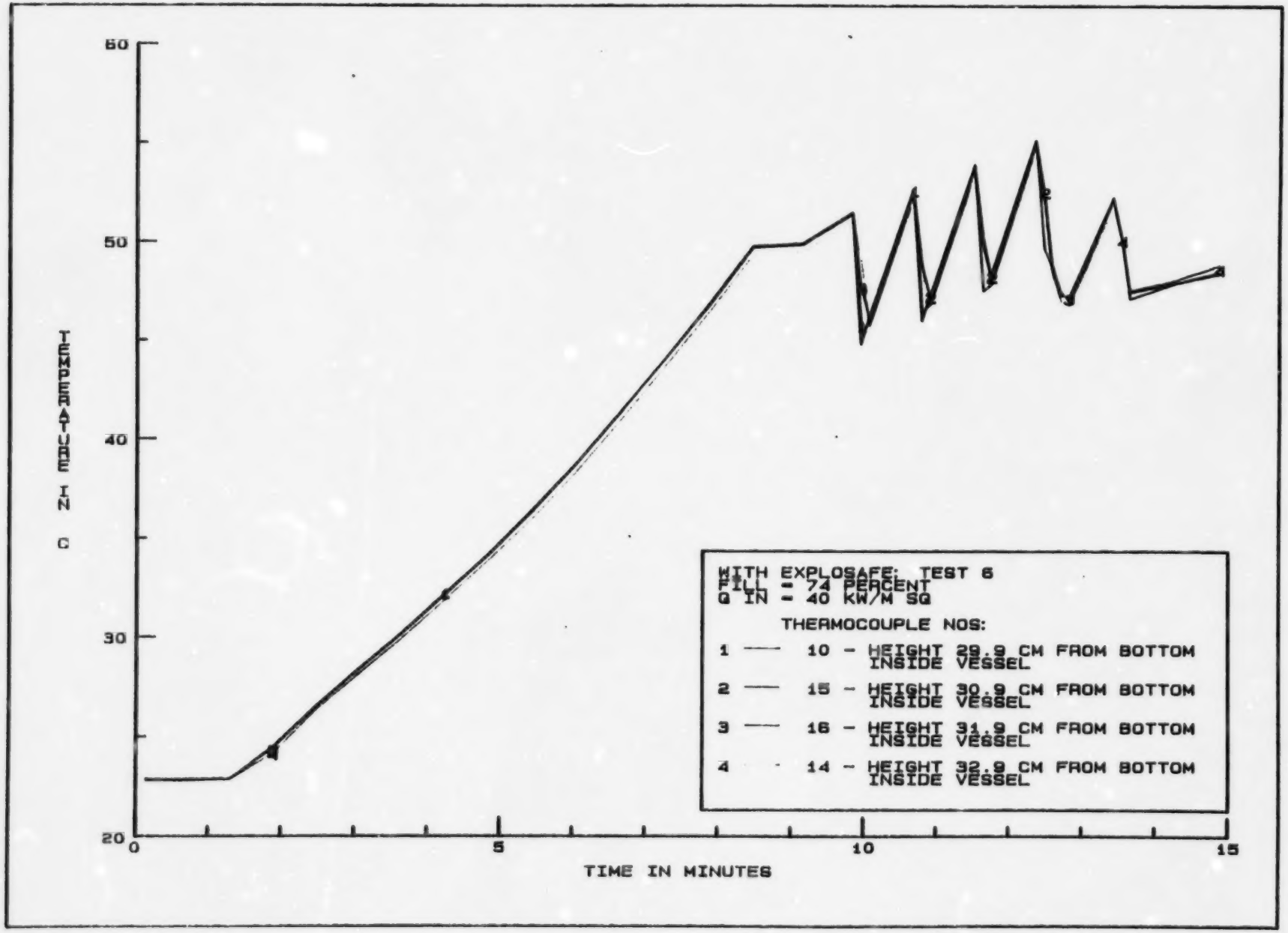
Thermocouple numbers.	Height (cm)	Angle with the vertical (Deg.)	Doubtful or faulty Thermocouple.
34	0	180	-
02	2.54	-	-
08	12.15	-	-
24	15.55	-	-
07	17.56	-	-
18	20.06	-	-
19	22.6	-	-
12	23.7	-	-
05	24.75	-	-
22	25.8	-	-
17	26.8	-	-
23	28.85	-	-
10	29.9.	-	-
15	30.9	-	-
16	31.9	-	-
14	32.9	-	-
13	33.95	-	-
11	36.5	-	-
1 & 35	-	42	-
6 & 3	-	86 & 138	-
9 & 25	20.35	-	-
4 & 21	12.20	-	-
30 & 28	-	25 & 25	-
29 & 27	-	55 & 55	-
26	-	308	-
38 & 37	-	86 & 138	-
31 & 31	-	135 & 220	-
32 & 33	-	295 & 50	-
20 & 40	Reference temperature	-	-

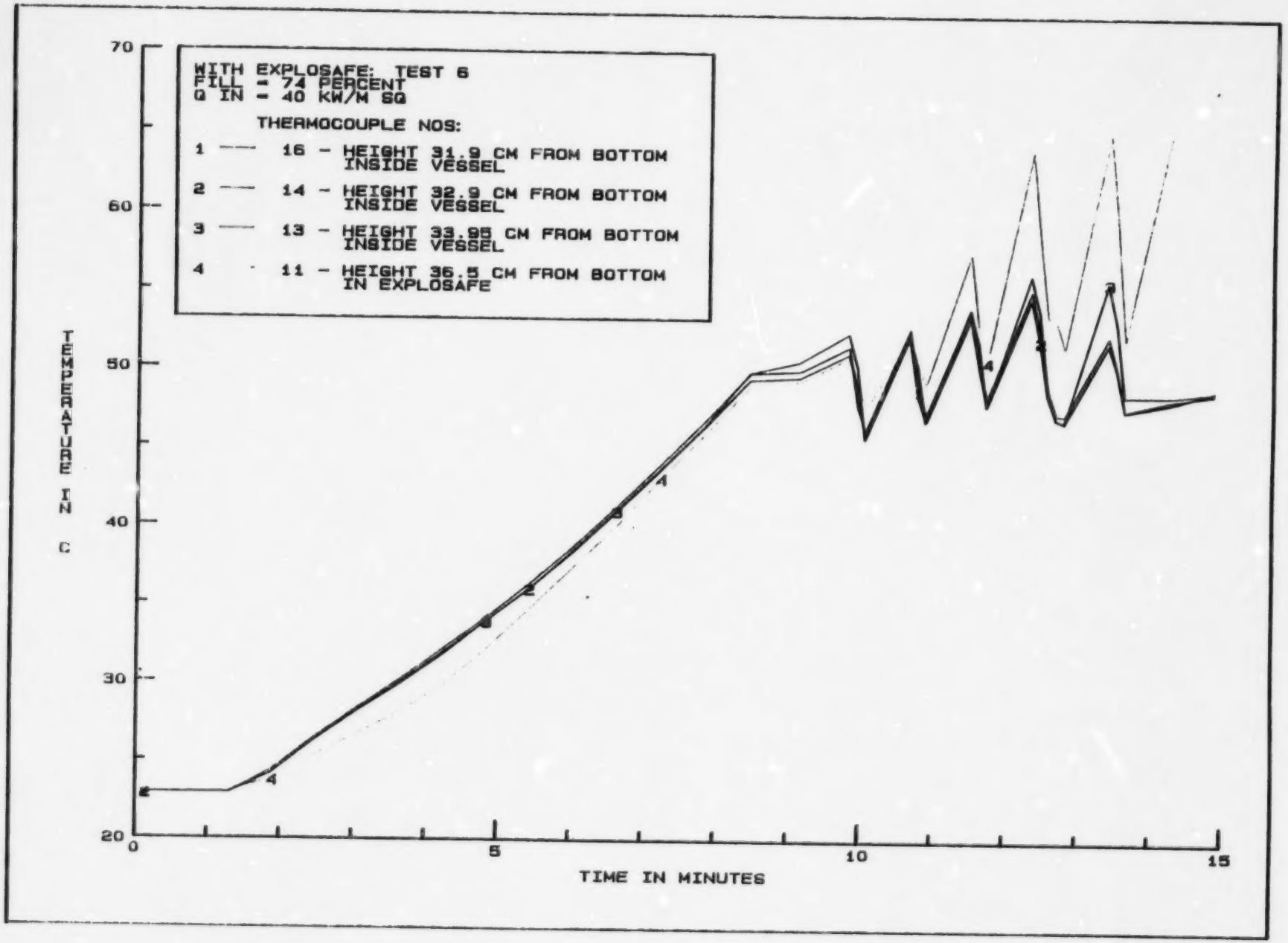
Fig. III.C A grid layout of thermocouples for an Explosafe equipped vessel. (Valid for 74, 58 and 23 percent liquid full cases)


WITH EXPLOSAFE: TEST 6
FILL - 74 PERCENT
Q IN - 40 KW/M SQ
THERMOCOUPLE NOS:
1 —— 34 - HEIGHT 0 CM FROM BOTTOM ON STEEL SHELL (I)
2 —— 2 - HEIGHT 2.54 CM FROM BOTTOM ON EXPLOSAFE
3 —— 8 - HEIGHT 12.15 CM FROM BOTTOM INSIDE VESSEL
4 · 24 - HEIGHT 15.55 CM FROM BOTTOM INSIDE VESSEL
TEMPERATURE IN C
50
45
40
35
30
25
0
5
10
15
TIME IN MINUTES


TEMPERATURE IN C
50
45
40
35
30
25
0
5
10
15
TIME IN MINUTES
WITH EXPLOSAFE: TEST 6
FILL - 74 PERCENT
Q IN - 40 KW/M SQ
THERMOCOUPLE NOS:
1 —— 7 - HEIGHT 17.56 CM FROM BOTTOM INSIDE VESSEL
2 —— 18 - HEIGHT 20.06 CM FROM BOTTOM INSIDE VESSEL
3 —— 19 - HEIGHT 22.6 CM FROM BOTTOM INSIDE VESSEL
4 —·— 12 - HEIGHT 23.7 CM FROM BOTTOM INSIDE VESSEL


TEMPERATURE IN C
50
40
30
20
0
5
10
15
TIME IN MINUTES
WITH EXPLOSAFE: TEST 6
FILL = 74 PERCENT
Q IN = 40 KW/M SQ
THERMOCOUPLE NOS:
1 —— 5 - HEIGHT 24.75 CM FROM BOTTOM INSIDE VESSEL
2 —— 22 - HEIGHT 25.8 CM FROM BOTTOM INSIDE VESSEL
3 —— 17 - HEIGHT 26.8 CM FROM BOTTOM INSIDE VESSEL
4 —·— 23 - HEIGHT 28.85 CM FROM BOTTOM INSIDE VESSEL


60
50
40
30
20
0
5
10
15
TEMPERATURE IN C
TIME IN MINUTES
WITH EXPLOSAFE: TEST 6
FILL = 74 PERCENT
Q IN = 40 KW/M SQ
THERMOCOUPLE NOS:
1 —— 10 - HEIGHT 29.9 CM FROM BOTTOM INSIDE VESSEL
2 —— 15 - HEIGHT 30.9 CM FROM BOTTOM INSIDE VESSEL
3 —— 16 - HEIGHT 31.9 CM FROM BOTTOM INSIDE VESSEL
4 - 14 - HEIGHT 32.9 CM FROM BOTTOM INSIDE VESSEL


WITH EXPLOSAFE: TEST 6
FILL = 74 PERCENT
Q IN = 40 KW/M SQ
THERMOCOUPLE NOS:
1 —— 16 - HEIGHT 31.9 CM FROM BOTTOM INSIDE VESSEL
2 —— 14 - HEIGHT 32.9 CM FROM BOTTOM INSIDE VESSEL
3 —— 13 - HEIGHT 33.98 CM FROM BOTTOM INSIDE VESSEL
4 —— 11 - HEIGHT 36.5 CM FROM BOTTOM IN EXPLOSAFE
TEMPERATURE IN C
70
60
50
40
30
20
0
5
10
15
TIME IN MINUTES

FOLLOWING ARE HEIGHT VS TEMPERATURE

PLOTS FOR THE

THERMOCOUPLES PLACED AT THE CENTRE

OF THE VESSEL

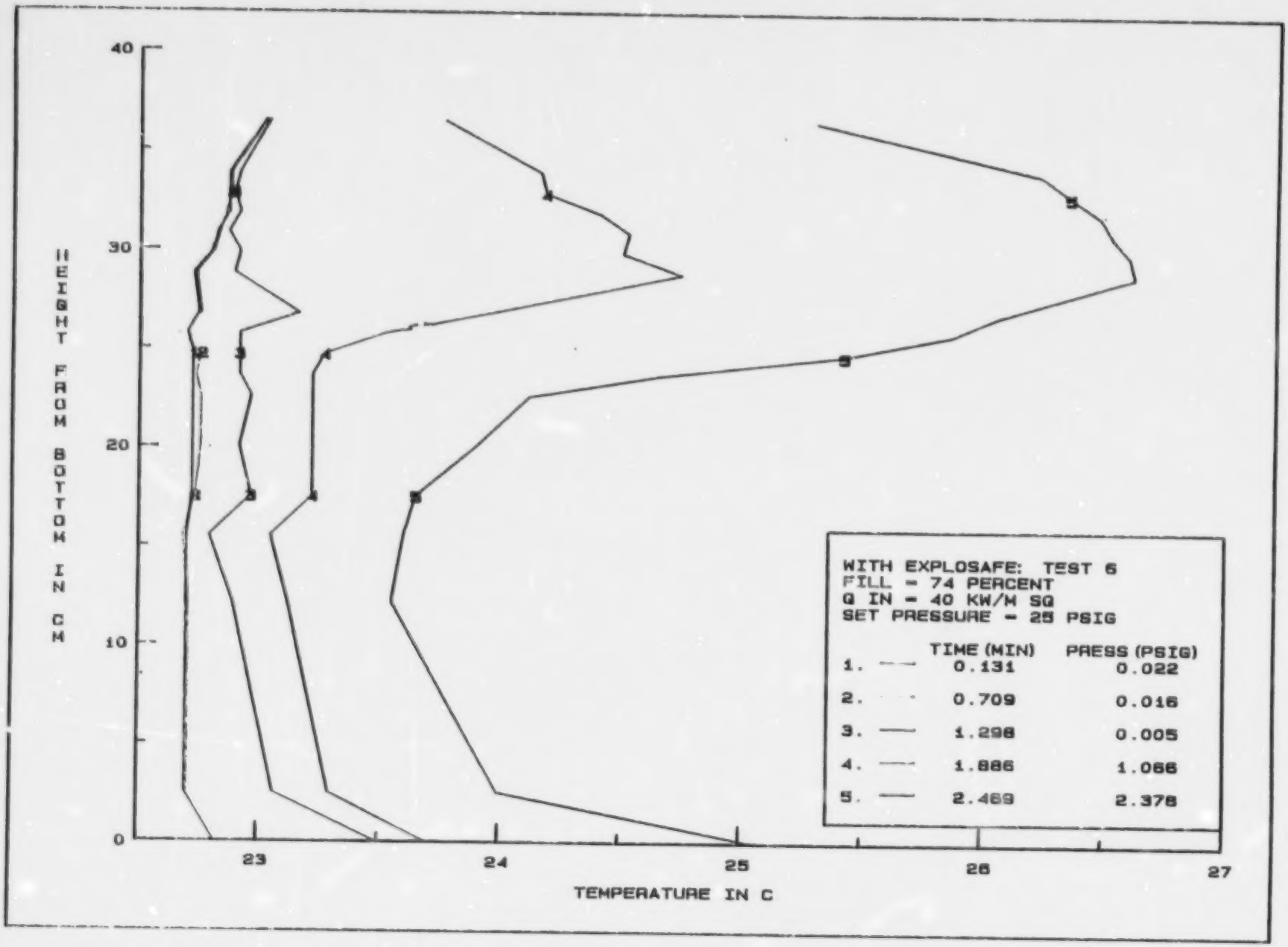
IN A VERTICAL AXIS

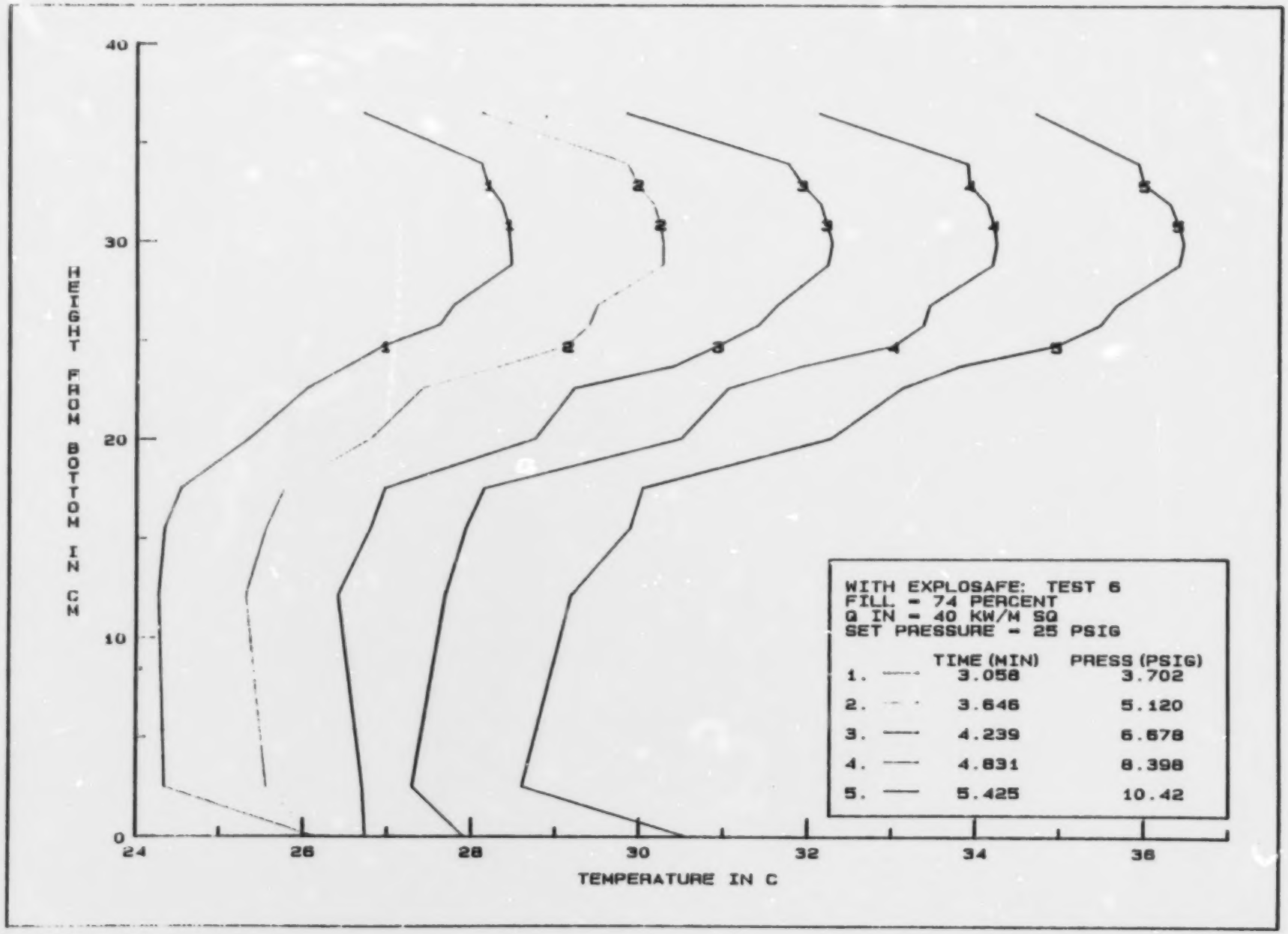
EACH PLOT REPRESENTS ONE SCAN OF

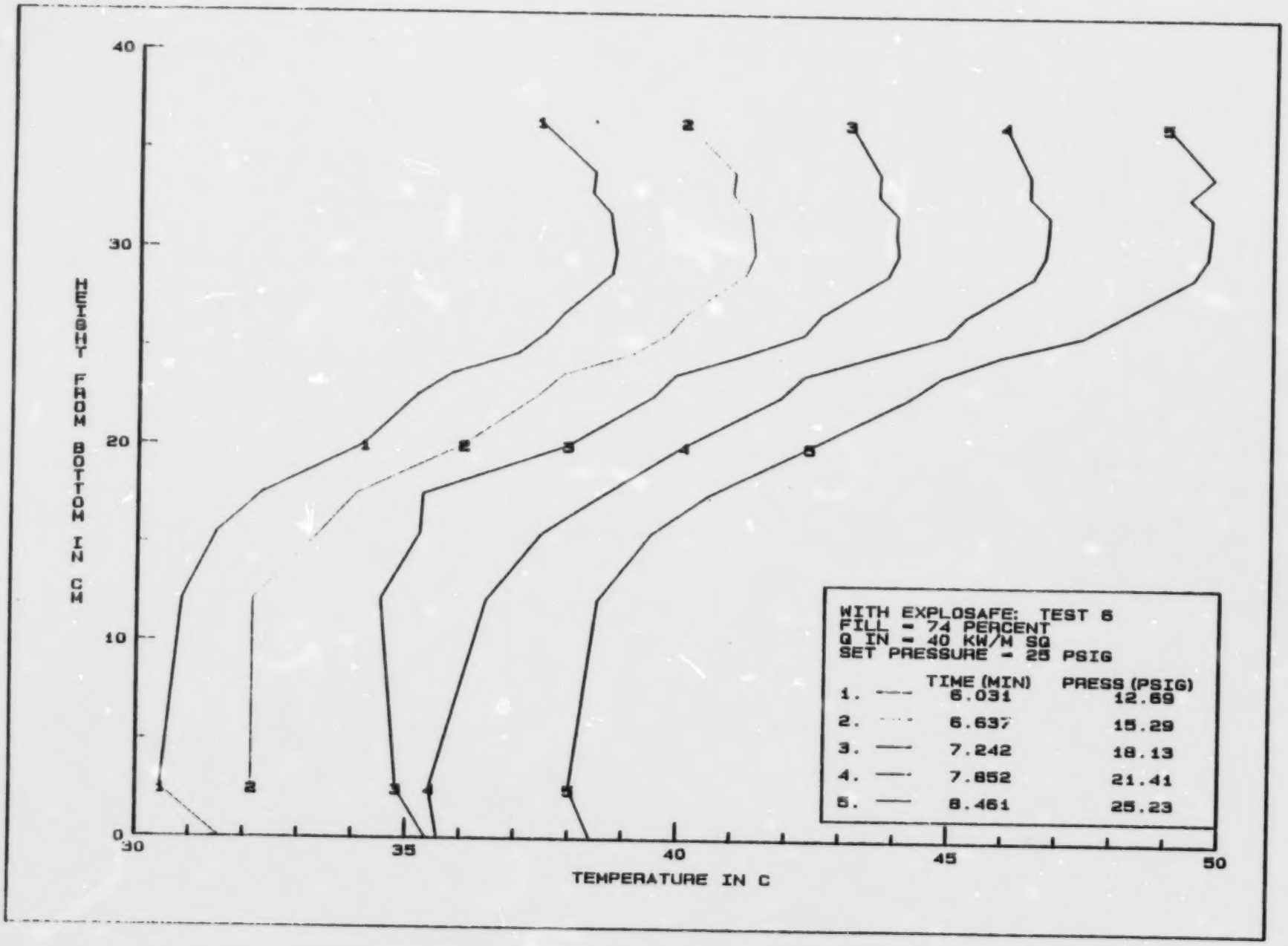
ALL THE THERMOCOUPLES

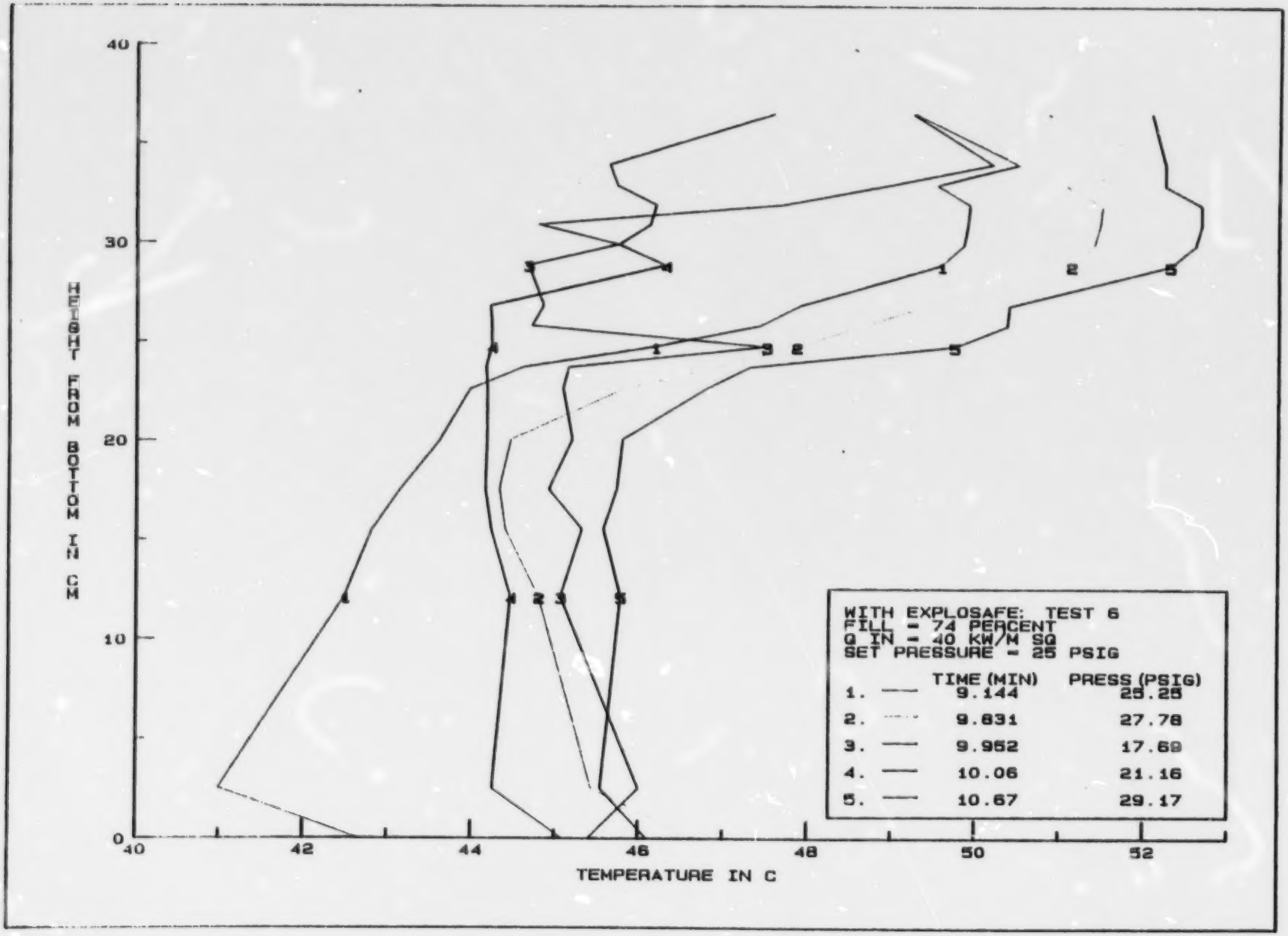
PLOTS ARE GIVEN AS FIVE (5) SCANS

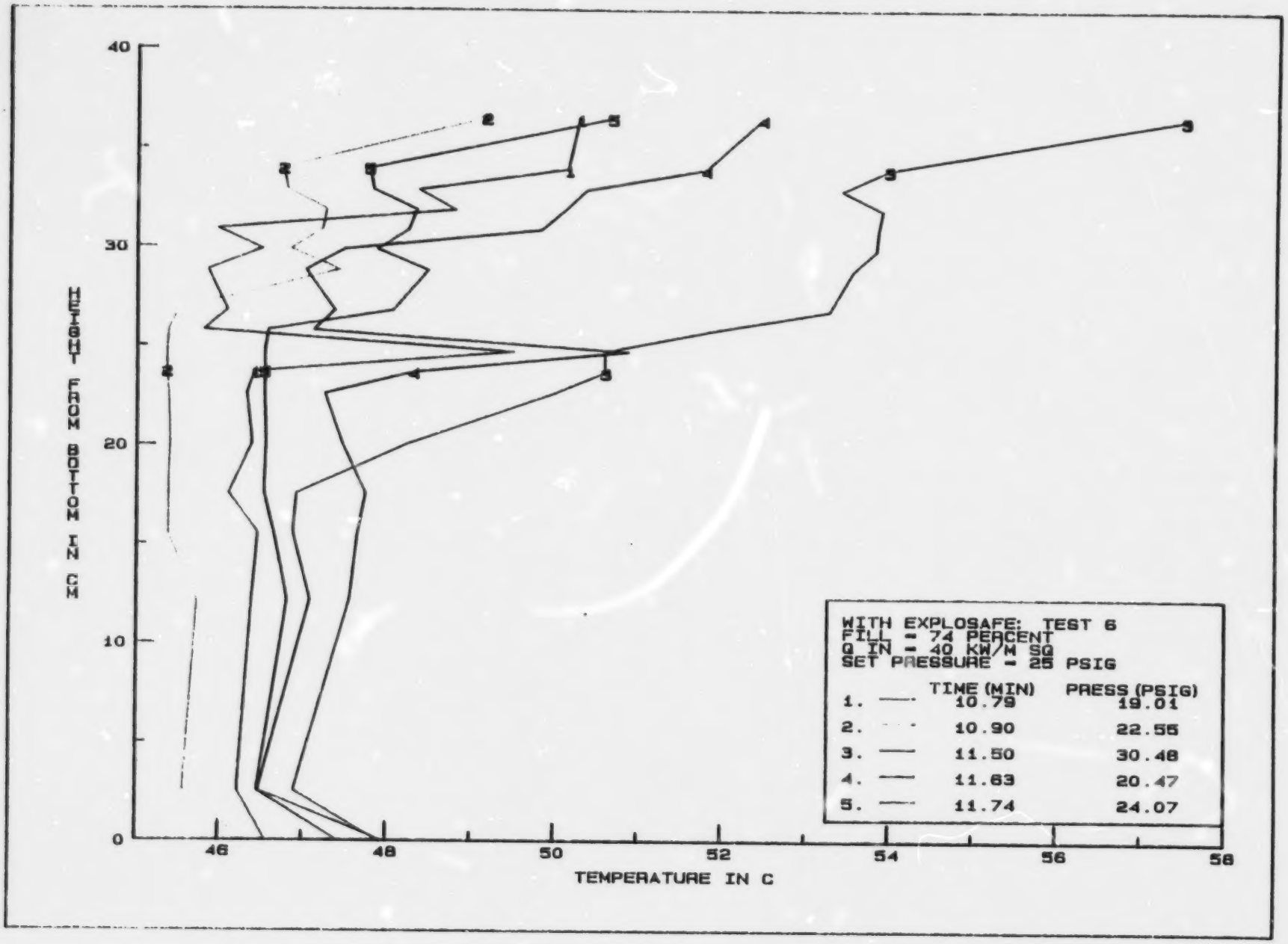
PER PAGE

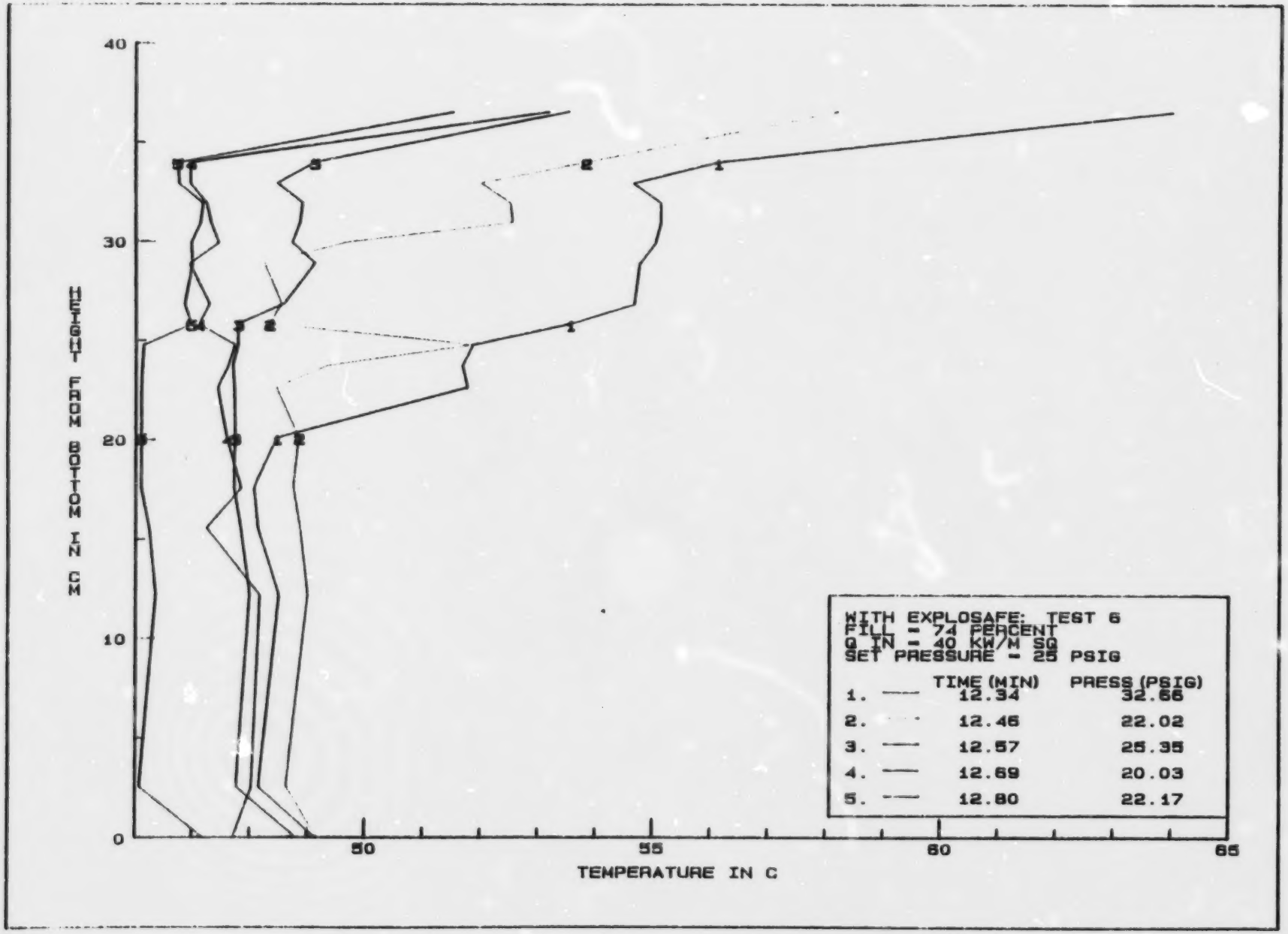

HEIGHT FROM BOTTOM IN CM
40
30
20
10
0
23
24
25
26
27
TEMPERATURE IN C
WITH EXPLOSAFE: TEST 6
FILL = 74 PERCENT
Q IN = 40 KW/M SQ
SET PRESSURE = 25 PSIG
TIME (MIN) PRESS (PSIG)
1. 0.131 0.022
2. 0.709 0.016
3. 1.298 0.005
4. 1.886 1.066
5. 2.469 2.378

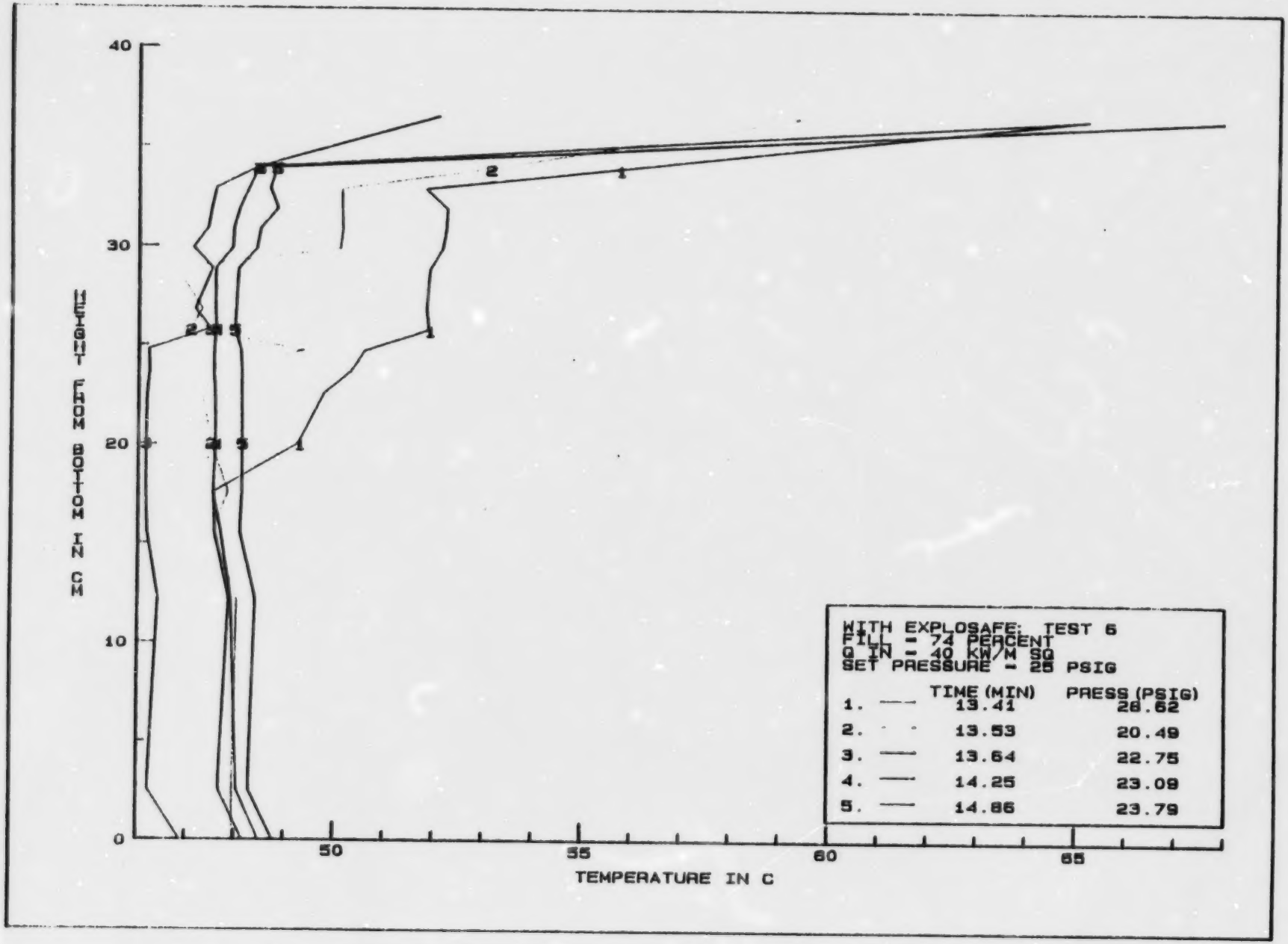

HEIGHT FROM BOTTOM IN CM
0
10
20
30
40
24
26
28
30
32
34
36
TEMPERATURE IN C
WITH EXPLOSAFE: TEST 6
FILL - 74 PERCENT
Q IN - 40 KW/M SQ
SET PRESSURE - 25 PSIG
TIME (MIN) PRESS (PSIG)
1. 3.058 3.702
2. 3.646 5.120
3. 4.239 6.678
4. 4.831 8.398
5. 5.425 10.42


HEIGHT FROM BOTTOM IN CM
40
30
20
10
0
30
35
40
45
50
TEMPERATURE IN C
WITH EXPLOSAFE: TEST 6
FILL = 74 PERCENT
Q IN = 40 KW/M SQ
SET PRESSURE = 25 PSIG
TIME (MIN) PRESS (PSIG)
1. 6.031 12.69
2. 6.637 15.29
3. 7.242 18.13
4. 7.852 21.41
5. 8.461 25.23


HEIGHT FROM BOTTOM IN CM
TEMPERATURE IN C
0
10
20
30
40
40
42
44
46
48
50
52
WITH EXPLOSAFE: TEST 6
FILL = 74 PERCENT
Q IN = 40 KW/M SQ
SET PRESSURE = 25 PSIG
TIME (MIN) PRESS (PSIG)
1. 9.144 25.25
2. 9.831 27.78
3. 9.952 17.69
4. 10.06 21.16
5. 10.67 29.17

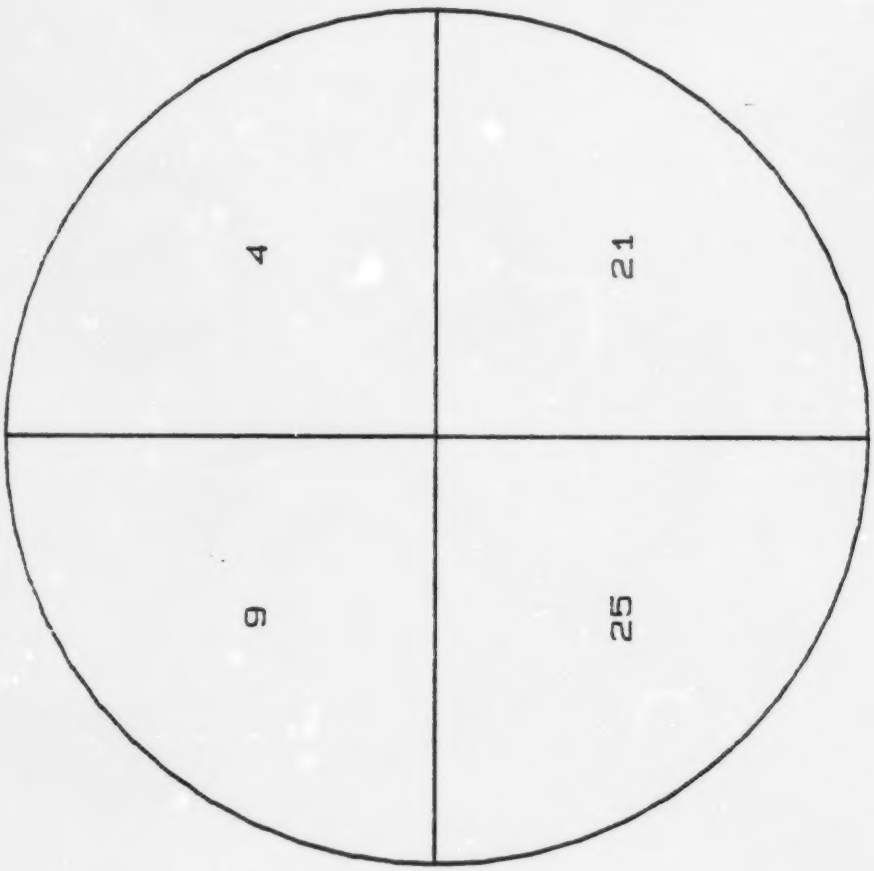

HEIGHT FROM BOTTOM IN CM
TEMPERATURE IN C
0
10
20
30
40
46
48
50
52
54
56
58
WITH EXPLOSAFE: TEST 6
FILL = 74 PERCENT
Q IN = 40 KW/M SQ
SET PRESSURE = 25 PSIG
TIME (MIN) PRESS (PSIG)
1. 10.79 19.01
2. 10.90 22.55
3. 11.50 30.48
4. 11.63 20.47
5. 11.74 24.07


HEIGHT FROM BOTTOM IN CM
40
30
20
10
0
50
55
60
65
TEMPERATURE IN C
WITH EXPLOSAFE: TEST 6
FILL = 74 PERCENT
Q IN = 40 KW/M SQ
SET PRESSURE = 25 PSIG
TIME (MIN) PRESS (PSIG)
1. 12.34 32.66
2. 12.46 22.02
3. 12.57 25.35
4. 12.69 20.03
5. 12.80 22.17


HEIGHT FROM BOTTOM IN CM
TEMPERATURE IN C
0
10
20
30
40
50
55
60
65
WITH EXPLOSAFE: TEST 6
FILL = 74 PERCENT
Q IN = 40 KW/M SQ
SET PRESSURE = 25 PSIG
TIME (MIN) PRESS (PSIG)
1. 13.41 28.62
2. 13.53 20.49
3. 13.64 22.75
4. 14.25 23.09
5. 14.86 23.79

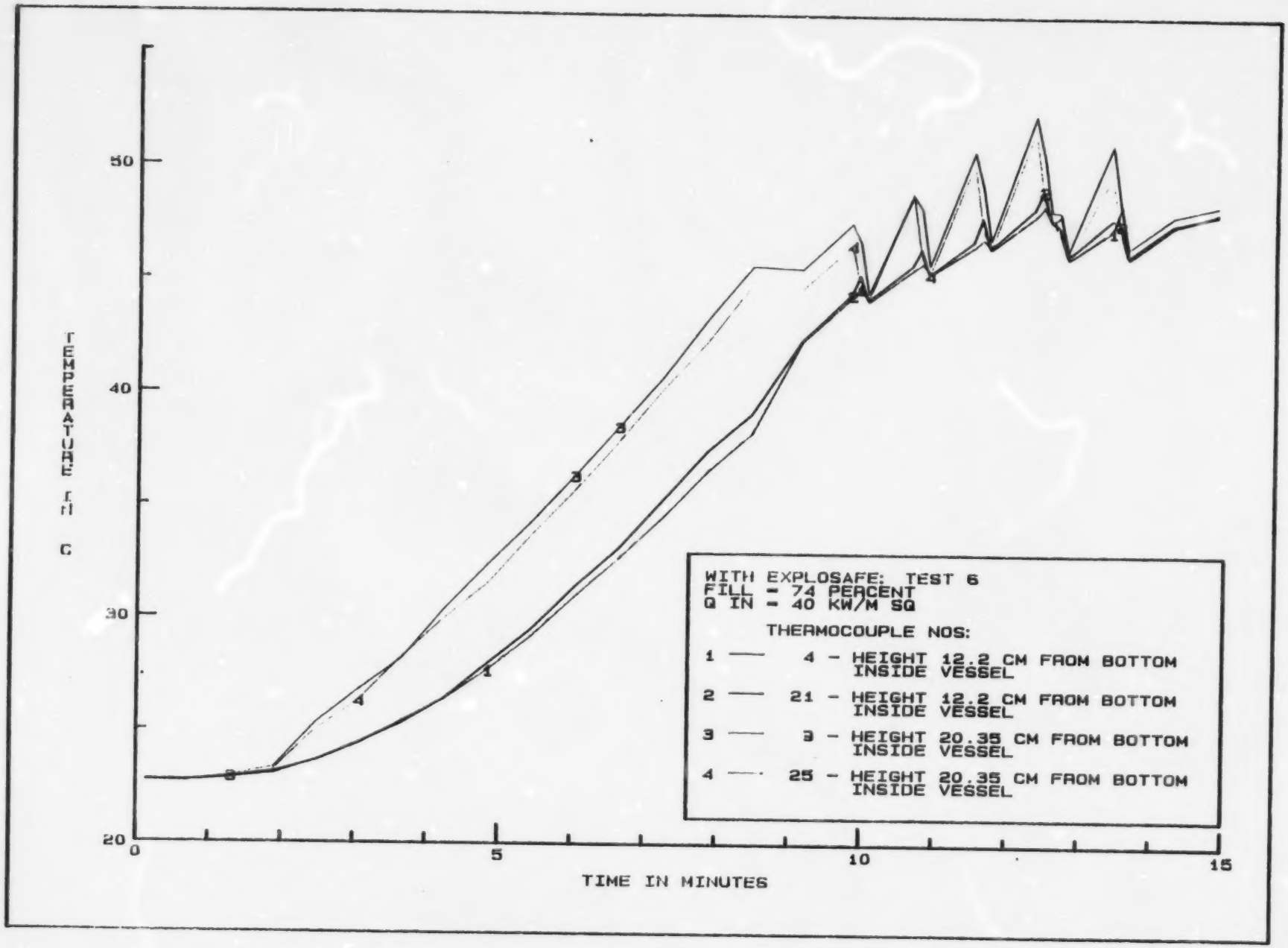
FOLLOWING FOUR THERMOCOUPLES ARE PLACED

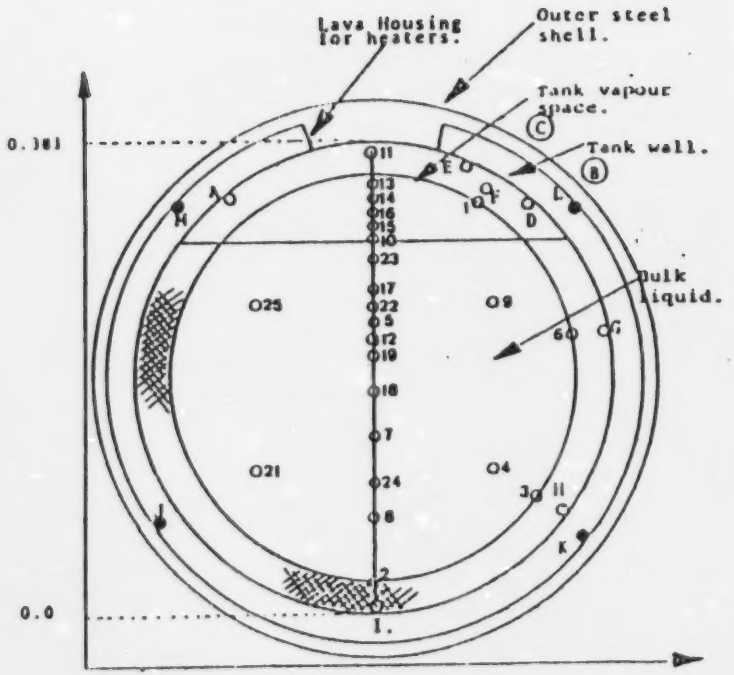
AT THE FOUR QUADRANTS ON A VERTICAL PLANE



THERMOCOUPLE NUM.	HEIGHT FROM BOTTOM IN CM
9 AND 25	20.35
4 AND 21	12.2

PLOTS ARE GIVEN . PER PAGE


50
40
30
20
0
5
10
15
TEMPERATURE IN C
TIME IN MINUTES
WITH EXPLOSAFE: TEST 6
FILL = 74 PERCENT
Q IN = 40 KW/M SQ
THERMOCOUPLE NOS:
1 —— 4 - HEIGHT 12.2 CM FROM BOTTOM INSIDE VESSEL
2 —— 21 - HEIGHT 12.2 CM FROM BOTTOM INSIDE VESSEL
3 —— 3 - HEIGHT 20.35 CM FROM BOTTOM INSIDE VESSEL
4 —— 25 - HEIGHT 20.35 CM FROM BOTTOM INSIDE VESSEL



SYMBOL	Thermocouple #	Angle(Deg)
A	26	308
B & D	27 & 29	55 & 55
C & E	28 & 30	25 & 25
G & H	38 & 37	86 & 138
I	34	180
J & K	31 & 36	220 & 135
L & M	33 & 32	50 & 295

Number 41 represents pressure in psig.
Number 42 represents time in seconds.

Thermocouple numbers.	Height (cm)	Angle with the vertical (Deg.)	Douhtful or faulty Thermocouple.
34	0	180	-
02	2.54	-	-
08	12.15	-	-
24	15.55	-	-
07	17.56	-	-
18	20.06	-	-
19	22.6	-	-
12	23.7	-	-
05	24.75	-	-
22	25.8	-	-
17	26.8	-	-
23	28.85	-	-
10	29.9.	-	-
15	30.9	-	-
16	31.9	-	-
14	32.9	-	-
13	33.95	-	-
11	36.5	-	-
1 & 35	-	42	-
6 & 3	-	86 & 138	-
9 & 25	20.35	-	-
4 & 21	12.20	-	-
30 & 28	-	25 & 25	-
29 & 27	-	55 & 55	-
26	-	308	-
38 & 37	-	86 & 138	-
35 & 31	-	135 & 220	-
32 & 33	-	295 & 50	-
20 & 40	Reference temperature	-	-

Circled thermocouples are ½ the depth of the tank back from thermocouples D & E

Fig. III.C A grid layout of thermocouples for an Explosafe equipped vessel. (Valid for 74, 58 and 23 percent liquid full cases)

FOLLOWING THERMOCOUPLES ARE PLACED

ON EXPLOSAFE OR

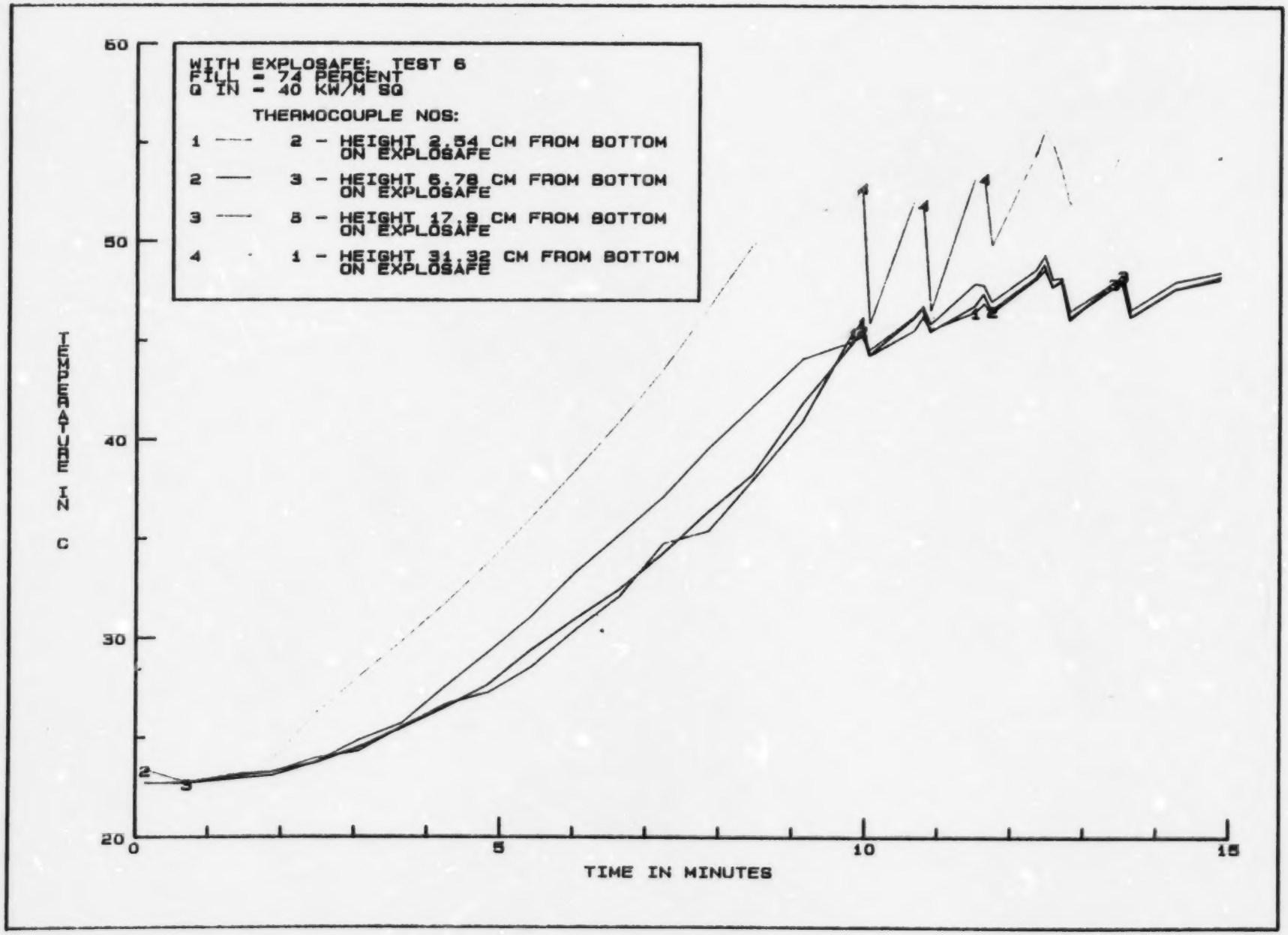
INSIDE EXPLOSAFE OR

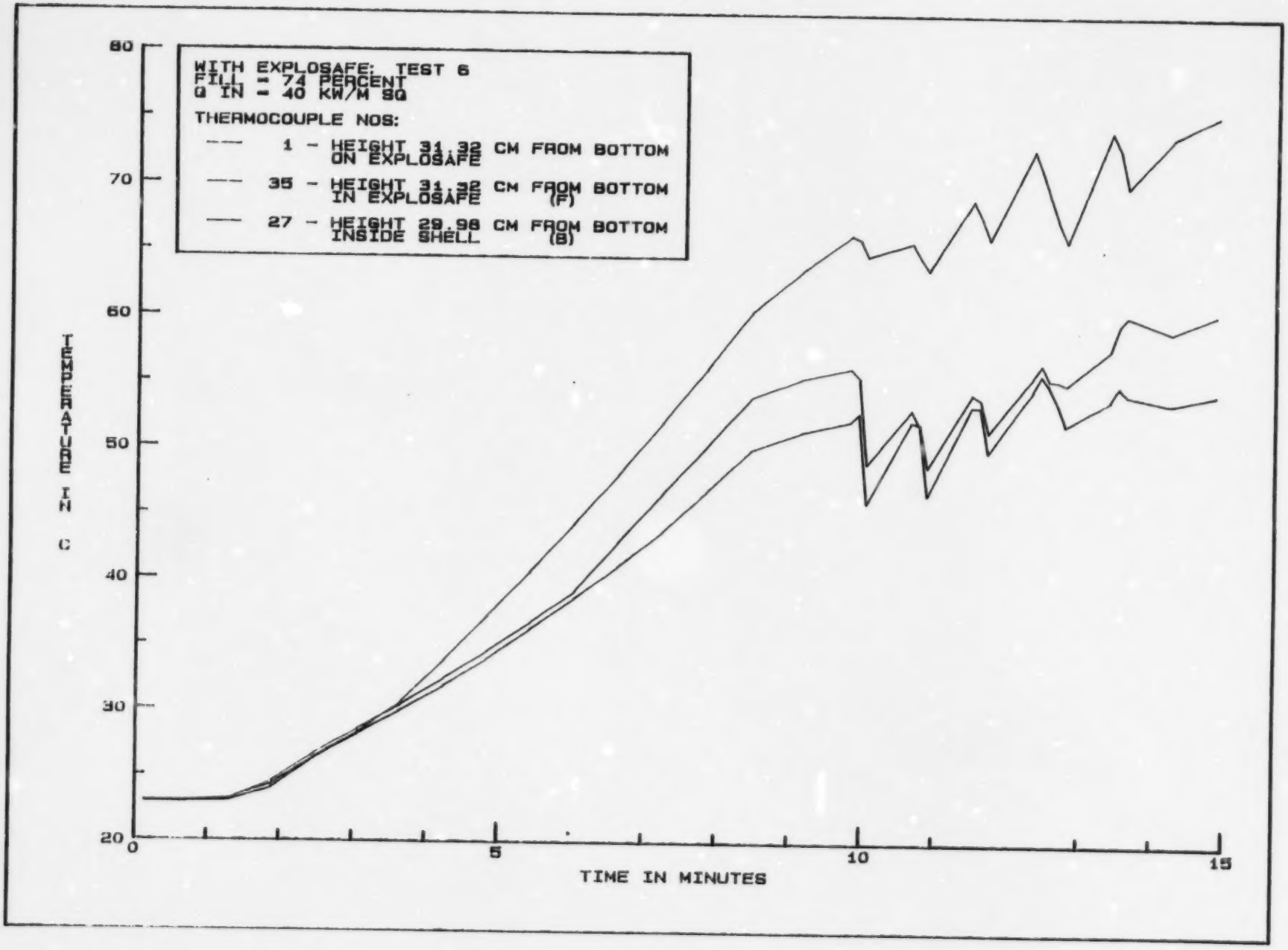
ON THE MILD STEEL SHELL OR

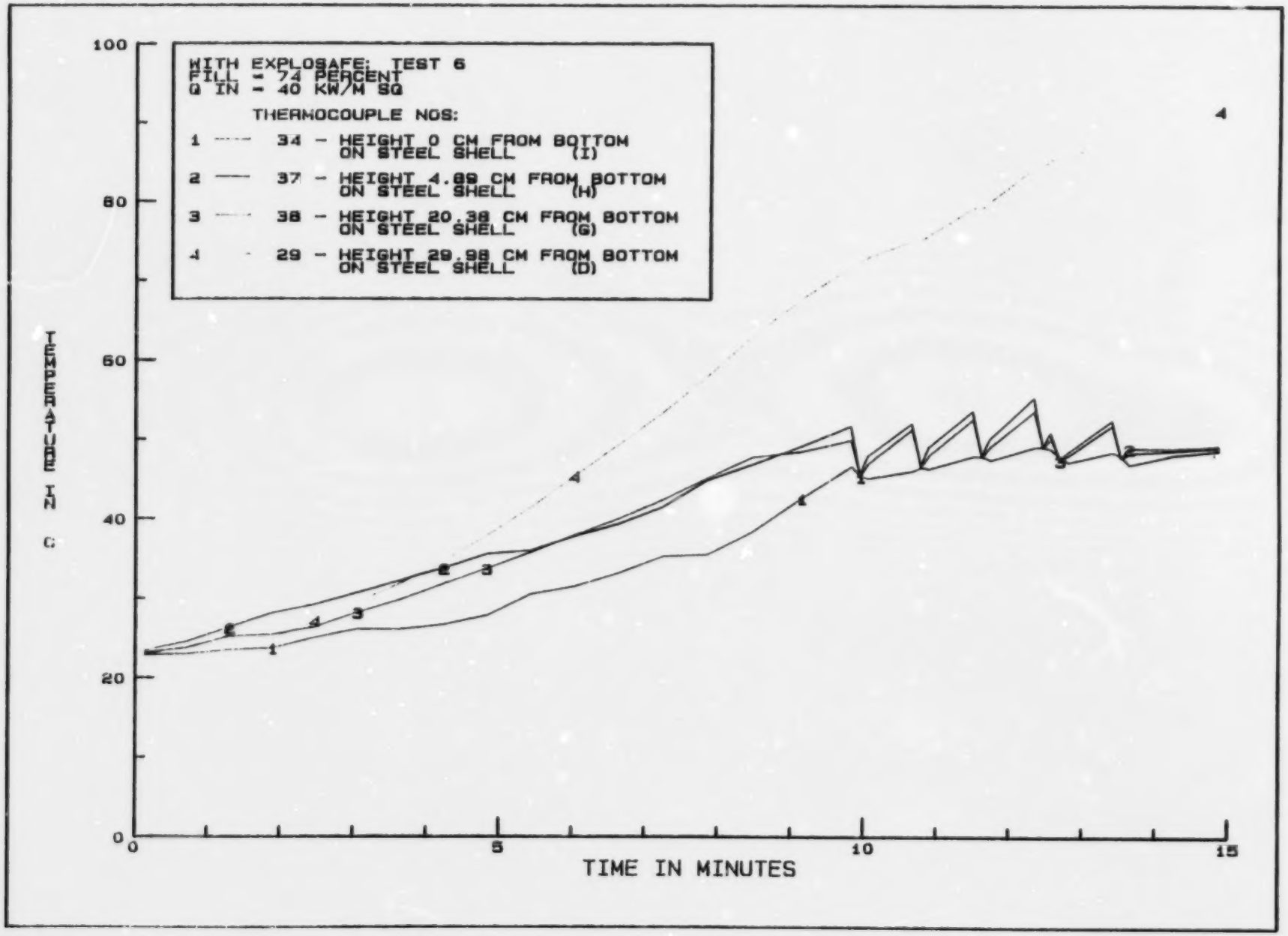
INSIDE THE MILD STEEL SHELL

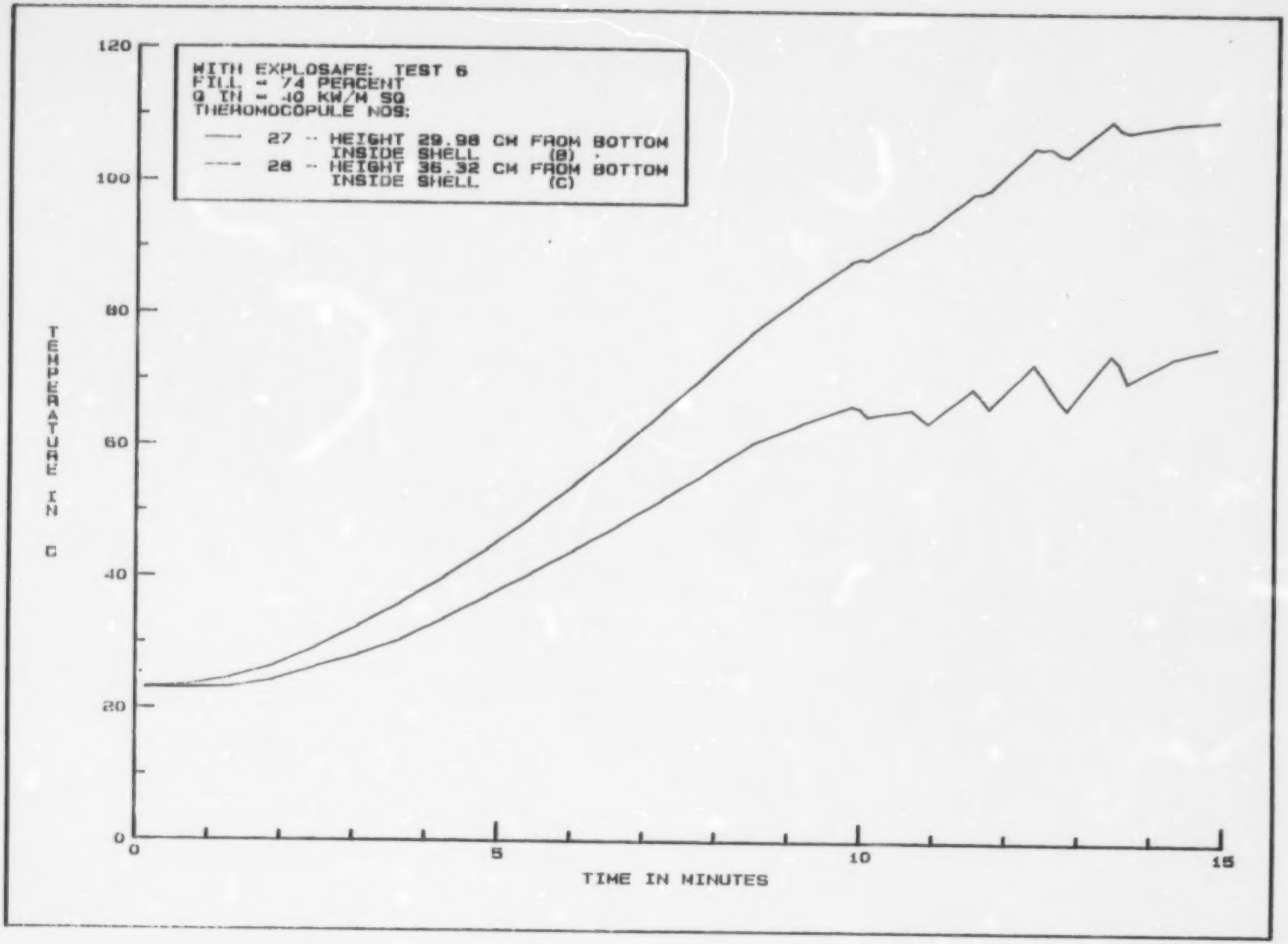
THERMOCOUPLE NUM.	HEIGHT FROM BOTTOM IN CM
ON EXPLOSAFE:	
2	2.54
3	6.78
6	17.9
1	31.32
INSIDE EXPLOSAFE:	
35 OR F	31.32
11	36.5
ON THE MILD STEEL SHELL:	
34 OR I	0
37 OR H	4.89
38 OR G	20.38
29 OR D	29.98
26 OR A	24.94
30 OR E	36.32
INSIDE THE MILD STEEL SHELL:	
27 OR B	29.98
28 OR C	36.32

PLOTS ARE GIVEN . PER PAGE


WITH EXPLOSAFE: TEST 6
FILL = 74 PERCENT
Q IN = 40 KW/M SQ
THERMOCOUPLE NOS:
1 —— 2 - HEIGHT 2.54 CM FROM BOTTOM ON EXPLOSAFE
2 —— 3 - HEIGHT 6.78 CM FROM BOTTOM ON EXPLOSAFE
3 —— 5 - HEIGHT 17.9 CM FROM BOTTOM ON EXPLOSAFE
4 1 - HEIGHT 31.32 CM FROM BOTTOM ON EXPLOSAFE
TEMPERATURE IN C
60
50
40
30
20
0
5
10
15
TIME IN MINUTES


WITH EXPLOSAFE: TEST 6
FILL = 74 PERCENT
Q IN = 40 KW/M SQ
THERMOCOUPLE NOS:
1 - HEIGHT 31.32 CM FROM BOTTOM ON EXPLOSAFE
35 - HEIGHT 31.32 CM FROM BOTTOM IN EXPLOSAFE (F)
27 - HEIGHT 29.98 CM FROM BOTTOM INSIDE SHELL (B)
TEMPERATURE IN C
80
70
60
50
40
30
20
0
5
10
15
TIME IN MINUTES


WITH EXPLOSAFE: TEST 6
FILL = 74 PERCENT
Q IN = 40 KW/M SQ
THERMOCOUPLE NOS:
1 ---- 34 - HEIGHT 0 CM FROM BOTTOM ON STEEL SHELL (I)
2 ---- 37 - HEIGHT 4.89 CM FROM BOTTOM ON STEEL SHELL (H)
3 ---- 38 - HEIGHT 20.38 CM FROM BOTTOM ON STEEL SHELL (G)
4 ---- 29 - HEIGHT 29.98 CM FROM BOTTOM ON STEEL SHELL (D)
TEMPERATURE IN C
100
80
60
40
20
0
0
5
10
15
TIME IN MINUTES

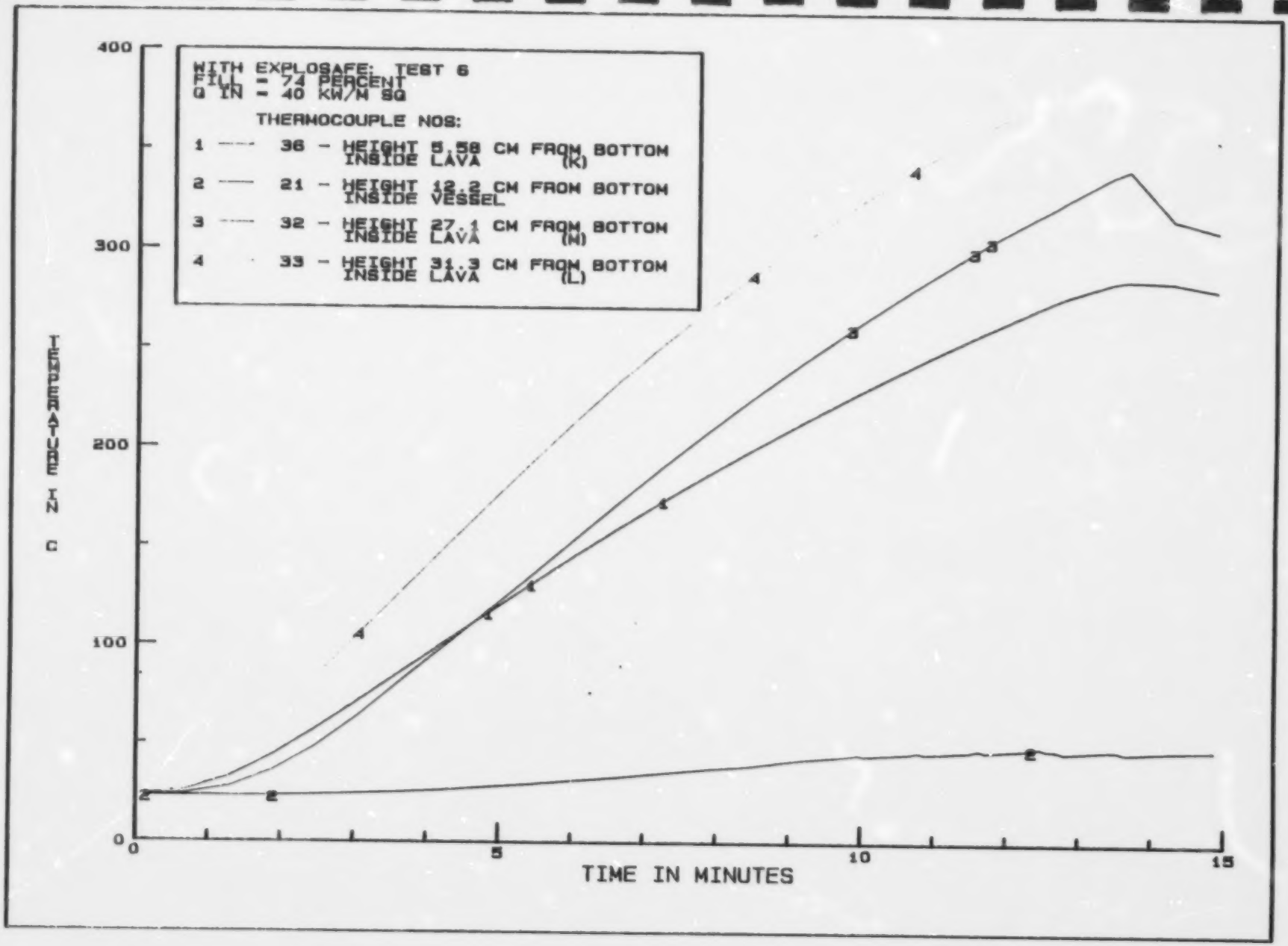

WITH EXPLOSAFE: TEST 6
FILL = 74 PERCENT
Q IN = 40 KW/M SQ
THERMOCOPULE NOS:
27 -- HEIGHT 29.98 CM FROM BOTTOM INSIDE SHELL (B)
28 -- HEIGHT 36.32 CM FROM BOTTOM INSIDE SHELL (C)
120
100
80
60
40
20
0
TEMPERATURE IN C
0
5
10
15
TIME IN MINUTES

FOLLOWING THERMOCOUPLES ARE PLACED

IN THE LAVA MEDIUM

THERMOCOUPLE NUM.	HEIGHT FROM BOTTOM IN CM
36 OR K	5.58
31 OR J	4.46
32 OR M	27.1
33 OR L	31.3

ALL FOUR PLOTS ARE GIVEN IN ONE PAGE


WITH EXPLOSAFE: TEST 6
FILL = 74 PERCENT
Q IN = 40 KW/M SQ
THERMOCOUPLE NOS:
1 —— 36 - HEIGHT 5.58 CM FROM BOTTOM INSIDE LAVA (K)
2 —— 21 - HEIGHT 12.2 CM FROM BOTTOM INSIDE VESSEL
3 —— 32 - HEIGHT 27.1 CM FROM BOTTOM INSIDE LAVA (N)
4 —— 33 - HEIGHT 31.3 CM FROM BOTTOM INSIDE LAVA (L)
TEMPERATURE IN C
400
300
200
100
0
0
5
10
15
TIME IN MINUTES

TEST 6

WITH EXPLOSAFE

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITH EXPLOSAFE - FILE NAME : TEST 6 (UNBT26)

DATA OF TEST :AUG/DEC 1983 Q IN = 40 KW/M SQ LIQUID LEVEL = 74 PERCENT

SET PRESSURE = 25 PSIG PRV ORIFICE DIAMETER = 3/8 INCHES

	TIME MINS	PRESSURE PSIG	THRM01 C	THRM02 C	THRM03 C	THRM04 C	THRM05 C	THRM06 C	THRM07 C	THRM08 C	THRM09 C	THRM010 C	THRM011 C
1.	0.131	0.022	22.873	22.700	23.366	22.724	22.724	22.700	22.724	22.700	22.700	22.799	23.021
2.	0.709	0.017	22.883	22.710	22.736	22.735	22.759	22.685	22.735	22.710	22.710	22.809	23.031
3.	1.298	0.006	22.965	23.064	23.138	22.841	22.915	22.915	22.965	22.891	22.940	22.915	23.039
4.	1.887	1.066	23.959	23.253	23.293	23.046	23.268	23.095	23.219	23.120	23.317	24.500	23.761
5.	2.469	2.379	26.229	23.992	23.721	23.623	25.419	23.746	23.647	23.549	25.321	26.597	25.296
6.	3.058	3.702	28.074	24.346	24.494	24.395	26.949	24.863	24.543	24.272	26.802	28.440	26.704
7.	3.646	5.120	29.862	25.559	25.461	25.412	29.131	25.706	25.780	25.313	28.180	30.276	28.106
8.	4.239	6.670	31.767	26.697	26.501	26.403	30.918	27.554	26.967	26.403	30.407	32.276	29.823
9.	4.832	8.398	33.831	27.293	27.660	27.709	33.010	29.296	28.149	27.685	32.381	34.242	32.114
10.	5.425	10.425	36.128	28.597	29.402	29.207	34.949	31.105	30.035	29.183	34.250	36.464	34.684
11.	6.031	12.698	38.487	30.459	30.969	31.017	37.002	33.319	32.303	30.847	36.354	38.798	37.362
12.	6.637	15.294	40.953	32.143	32.458	32.724	39.118	35.210	34.083	32.143	38.545	41.358	40.048
13.	7.243	18.136	43.597	34.810	34.280	34.545	41.177	37.142	35.268	34.497	40.773	43.999	43.076
14.	7.852	21.414	46.695	35.421	36.359	36.575	43.582	39.566	38.587	36.455	43.345	46.719	45.942
15.	8.461	25.239	49.871	38.001	38.240	38.264	45.883	41.673	40.531	38.503	45.671	49.708	48.936
16.	9.145	25.256	51.258	40.993	41.825	42.371	46.175	44.076	43.153	42.490	45.540	49.858	49.273
17.	9.831	27.785	52.131	45.433	44.867	44.324	47.856	44.961	44.324	44.796	47.597	51.409	50.849
18.	9.952	17.690	52.760	46.001	45.553	44.775	47.505	45.223	44.916	45.058	46.730	45.742	49.240
19.	10.062	21.163	45.883	44.255	44.255	44.137	44.231	44.515	44.160	44.468	44.491	45.742	47.576
20.	10.670	29.175	52.121	45.541	46.130	45.565	49.742	46.201	45.730	45.777	48.830	52.609	52.074
21.	10.791	19.018	51.912	46.225	46.625	45.825	49.509	46.743	46.107	45.390	48.222	46.507	50.280
22.	10.901	22.559	46.509	45.567	45.450	45.355	45.355	45.827	45.379	45.732	45.756	46.839	49.160
23.	11.509	30.482	53.320	46.474	46.756	46.591	50.597	47.883	46.921	47.085	50.784	53.830	57.503
24.	11.631	20.476	53.252	46.999	47.369	46.923	50.879	47.768	47.744	47.557	49.221	47.486	52.462
25.	11.741	24.077	49.831	46.454	46.548	46.478	46.525	46.971	46.525	46.807	46.877	47.864	50.671
26.	12.348	32.665	54.564	48.157	48.204	47.946	51.871	48.602	48.063	48.508	52.383	55.049	54.015
27.	12.469	22.023	55.790	48.626	48.884	48.392	51.895	49.329	48.743	49.001	50.567	49.656	58.186
28.	12.579	25.351	54.914	47.761	47.714	47.667	47.784	48.089	47.714	47.995	48.160	48.722	53.523
29.	12.700	20.035	53.549	48.044	48.068	47.997	47.739	48.185	47.857	48.185	48.115	47.458	53.177
30.	12.810	22.173	51.902	46.073	46.144	46.050	46.144	46.473	46.097	46.356	46.426	46.967	51.506
31.	13.416	28.628	53.862	48.033	47.728	47.353	50.583	47.963	47.517	47.893	51.119	52.144	55.100
32.	13.536	20.493	54.954	47.942	47.895	48.435	49.348	48.364	47.825	48.013	48.388	50.072	59.308
33.	13.647	22.754	54.238	46.229	46.205	46.088	46.205	46.558	46.158	46.417	46.558	47.099	52.056
34.	14.259	23.095	53.563	47.673	47.650	47.532	47.532	48.002	47.532	47.861	47.978	47.908	55.183
35.	14.870	23.798	54.329	48.271	48.130	48.107	48.060	48.482	48.107	48.388	48.435	48.388	57.887

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITH EXPLOSAFE - FILE NAME : TEST 6 (UNBT26)

DATA OF TEST :AUG/DEC 1983 Q IN = 40 KW/M SQ LIQUID LEVEL = 74 PERCENT

SET PRESSURE = 25 PSIG PRV ORIFICE DIAMETER = 3/8 INCHES

	TIME MINS	PRESSURE PSIG	THRM#12 C	THRM#13 C	THRM#14 C	THRM#15 C	THRM#16 C	THRM#17 C	THRM#18 C	THRM#19 C	THRM#20 C	THRM#21 C	THRM#22 C
1.	0.131	0.022	22.724	22.873	22.873	22.923	22.873	22.749	22.724	22.724	2.764	22.700	22.700
2.	0.709	0.017	22.735	22.883	22.883	22.933	22.858	22.759	22.759	22.759	2.765	22.685	22.660
3.	1.298	0.006	22.915	22.915	22.891	22.866	22.915	23.162	22.915	22.965	2.766	22.866	22.915
4.	1.887	1.066	23.219	24.156	24.180	24.825	24.402	23.934	23.219	23.219	2.767	23.095	23.515
5.	2.469	2.379	24.657	26.229	26.352	26.523	26.474	26.057	23.894	24.115	2.767	23.623	25.861
6.	3.058	3.702	25.508	28.098	28.172	28.416	28.343	27.781	25.355	26.042	2.768	24.420	27.610
7.	3.646	5.120	28.326	29.838	29.960	30.227	30.154	29.497	26.810	27.422	2.769	25.289	29.400
8.	4.239	6.678	30.383	31.743	31.912	32.203	32.131	31.622	28.751	29.215	2.770	26.403	31.403
9.	4.832	8.398	31.896	33.880	33.904	34.193	34.121	33.445	30.488	31.047	2.771	27.953	33.372
10.	5.425	10.425	33.792	35.912	35.984	36.392	36.295	35.671	32.268	33.115	2.772	29.475	35.479
11.	6.031	12.698	35.778	38.391	38.343	38.726	38.678	37.841	34.164	35.152	2.773	31.406	37.506
12.	6.637	15.294	37.851	40.977	40.930	41.310	41.262	40.096	36.004	37.372	2.774	33.135	39.786
13.	7.243	18.136	39.915	43.644	43.620	43.951	43.975	42.578	37.932	39.510	2.775	35.268	42.270
14.	7.852	21.414	42.278	46.413	46.413	46.766	46.789	45.259	40.067	41.851	2.776	37.438	44.905
15.	8.461	25.239	44.822	49.801	49.357	49.755	49.778	48.092	42.385	44.232	2.777	39.101	47.412
16.	9.145	25.256	44.596	50.511	49.530	49.904	49.928	47.891	43.627	43.991	2.778	42.371	47.422
17.	9.831	27.785	46.893	52.340	51.059	51.479	51.502	49.402	44.466	45.810	2.779	44.466	48.629
18.	9.952	17.690	45.152	50.198	48.959	44.775	47.693	44.845	45.199	45.081	2.779	45.317	44.704
19.	10.062	21.163	44.160	45.624	45.718	46.118	46.189	44.208	44.184	44.184	2.779	44.208	44.231
20.	10.670	29.175	47.306	52.237	52.237	52.679	52.679	50.396	45.800	46.789	2.781	45.753	50.373
21.	10.791	19.018	46.413	50.140	48.362	45.966	48.807	46.084	46.390	46.319	2.781	46.460	45.801
22.	10.901	22.559	45.365	46.744	46.792	47.215	47.262	45.497	45.402	45.379	2.781	45.365	45.379
23.	11.509	30.482	50.697	53.969	53.413	53.853	53.900	53.273	48.235	49.967	2.782	46.827	51.879
24.	11.631	20.476	48.307	51.788	50.366	49.829	50.109	47.369	47.463	47.251	2.782	47.862	47.111
25.	11.741	24.077	46.525	47.770	47.817	48.239	48.333	48.051	46.548	46.525	2.782	46.548	46.572
26.	12.348	32.665	51.685	56.112	54.656	55.142	55.142	54.679	48.461	51.778	2.784	48.274	53.544
27.	12.469	22.023	49.329	53.823	51.988	52.546	52.500	48.533	48.837	48.439	2.784	49.118	48.322
28.	12.579	25.351	47.690	49.120	48.464	48.862	48.909	48.581	47.737	47.714	2.784	47.784	47.784
29.	12.700	20.035	47.622	46.964	46.964	47.317	47.245	47.293	47.598	47.434	2.784	47.434	47.105
30.	12.810	22.173	46.120	46.732	46.756	47.132	47.179	46.850	46.097	46.097	2.784	46.167	46.967
31.	13.416	28.628	50.303	55.714	51.795	52.214	52.237	51.818	49.251	49.766	2.785	47.822	51.865
32.	13.539	20.493	47.708	53.100	50.095	50.119	50.095	47.285	47.473	47.285	2.786	47.661	47.050
33.	13.647	22.754	46.229	48.413	47.869	47.404	47.475	47.146	46.158	46.182	2.786	46.182	47.451
34.	14.259	23.095	47.532	48.447	48.236	47.931	48.049	47.556	47.579	47.556	2.787	47.603	47.579
35.	14.870	23.798	48.084	48.787	48.646	48.459	48.810	47.966	48.107	48.084	2.788	48.060	47.943

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITH EXPLOSAFE - FILE NAME : TEST 6 (UNBT26)

DATA OF TEST :AUG/DEC 1983 Q IN = 40 KW/M SQ LIQUID LEVEL = 74 PERCENT

SET PRESSURE = 25 PSIG PRV ORIFICE DIAMETER = 3/8 INCHES

	TIME MINS	PRESSURE PSIG	THRM023 C	THRM024 C	THRM025 C	THRM026 C	THRM027 C	THRM028 C	THRM029 C	THRM030 C	THRM031 C	THRM032 C	THRM033 C
1.	0.131	0.022	22.724	22.700	22.675	22.961	22.981	23.058	23.058	23.174	23.039	23.194	25.031
2.	0.709	0.017	22.736	22.686	22.685	23.065	23.007	23.452	23.181	23.762	23.549	24.226	32.837
3.	1.298	0.006	22.891	22.792	22.841	23.481	23.190	24.603	23.752	25.240	25.260	27.904	45.235
4.	1.887	1.066	24.746	23.046	23.219	24.920	24.301	26.407	24.843	27.565	29.414	36.360	63.003
5.	2.469	2.379	26.621	23.598	25.026	26.996	26.320	29.231	27.180	31.116	35.929	48.534	83.873
6.	3.058	3.702	28.465	24.346	26.336	29.141	28.217	32.544	29.526	34.883	44.518	64.293	105.810
7.	3.646	5.120	30.276	25.559	28.253	31.457	30.535	36.040	31.918	38.964	54.618	82.181	127.560
8.	4.239	6.678	32.227	26.795	30.019	34.383	33.750	39.965	34.747	43.489	65.883	99.741	149.500
9.	4.832	8.398	34.193	27.929	31.557	37.760	37.148	44.240	38.008	48.320	77.871	117.170	171.190
10.	5.425	10.425	36.416	29.889	33.695	40.993	40.573	48.915	41.507	53.492	90.556	135.050	192.520
11.	6.031	12.698	38.726	31.479	35.705	44.332	44.218	54.105	45.453	58.834	103.680	153.690	213.750
12.	6.637	15.294	41.191	33.377	37.899	48.023	47.947	59.518	49.444	64.305	116.680	172.310	233.940
13.	7.243	18.136	43.810	35.220	40.249	51.761	51.932	65.252	53.443	69.872	129.760	190.530	252.830
14.	7.852	21.414	46.507	37.462	42.378	55.451	56.092	71.113	58.032	75.625	142.820	208.210	270.970
15.	8.461	25.239	49.451	39.482	44.893	59.396	60.480	77.142	63.040	81.379	155.490	225.240	287.880
16.	9.145	25.256	49.577	42.022	44.690	57.769	63.556	82.817	67.788	84.967	169.260	243.430	305.440
17.	9.831	27.788	51.129	44.395	46.658	59.927	66.320	88.050	71.945	88.993	182.650	260.720	322.450
18.	9.952	17.690	44.657	45.817	44.869	57.669	65.930	88.589	72.414	92.162	184.980	263.750	325.380
19.	10.062	21.163	46.307	44.231	44.208	58.404	64.694	88.387	73.068	91.049	187.050	266.400	327.920
20.	10.670	29.178	52.307	45.565	49.017	58.132	65.791	92.352	75.091	91.244	198.350	280.970	341.620
21.	10.791	19.018	45.848	46.460	46.184	58.021	64.593	92.703	75.185	85.418	200.540	283.780	344.240
22.	10.901	22.559	47.426	45.379	45.379	62.404	63.697	93.241	75.896	84.865	202.510	286.310	346.600
23.	11.509	30.482	53.552	46.874	50.341	60.215	69.041	98.504	79.327	95.243	213.170	300.220	359.150
24.	11.631	20.476	47.017	47.551	47.392	60.818	67.641	98.551	79.292	90.317	215.240	302.900	361.580
25.	11.741	24.077	48.473	46.642	46.501	59.015	66.089	99.170	80.148	91.297	217.110	305.320	363.700
26.	12.348	32.665	54.772	48.133	51.801	63.045	72.845	105.490	84.518	100.120	227.170	317.590	375.360
27.	12.469	22.023	48.228	48.851	48.767	63.778	71.093	105.270	84.649	95.646	229.120	319.870	377.570
28.	12.579	25.351	49.120	47.831	47.831	60.025	69.282	105.490	85.503	96.623	230.940	321.910	379.440
29.	12.700	20.035	46.941	47.246	47.176	60.553	67.340	104.480	85.412	93.712	233.010	324.450	381.260
30.	12.810	22.173	46.991	46.238	46.218	59.352	65.957	104.170	85.747	95.743	234.850	326.860	382.760
31.	13.416	26.628	51.888	47.681	49.789	63.267	74.314	109.670	88.495	101.530	244.130	338.850	395.110
32.	13.538	20.493	46.768	47.496	47.191	64.864	72.883	108.330	88.314	97.892	246.100	340.630	394.860
33.	13.647	22.754	47.498	46.182	46.205	62.972	70.085	107.890	88.612	98.226	247.740	342.010	394.300
34.	14.259	23.095	47.556	47.556	47.603	62.533	73.846	109.150	89.935	99.525	257.980	356.930	369.110
35.	14.870	23.798	48.013	48.060	48.060	70.819	75.536	109.730	91.722	100.530	268.340	311.050	356.360

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITH EXPLOSAFE - FILE NAME : TEST 6 (UNBT26)

DATA OF TEST :AUG/DEC 1983 Q IN = 40 KW/M SQ LIQUID LEVEL = 74 PERCENT

SET PRESSURE = 25 PSIG PRV ORIFICE DIAMETER = 3/8 INCHES

	TIME MINS	PRESSURE PSIG	THRM034 C	THRM035 C	THRM036 C	THRM037 C	THRM038 C	THRM039 C	THRM040 C
1.	0.131	0.022	22.826	22.903	23.852	23.280	23.019	*******	2.777
2.	0.709	0.017	22.988	22.830	26.236	24.420	23.665	*******	2.778
3.	1.298	0.006	23.500	23.055	33.115	26.245	25.163	0.006	2.779
4.	1.887	1.066	23.702	24.456	44.141	28.027	25.364	0.013	2.780
5.	2.469	2.379	25.064	26.571	57.375	29.115	26.339	0.032	2.781
6.	3.058	3.702	26.153	28.448	71.774	30.523	28.197	*******	2.781
7.	3.646	5.120	26.142	30.304	86.518	32.187	29.823	*******	2.782
8.	4.239	6.678	26.730	32.330	101.420	33.750	31.831	*******	2.783
9.	4.832	8.398	27.915	34.411	116.200	35.541	33.759	0.016	2.784
10.	5.425	10.425	30.580	36.640	130.750	35.989	35.779	0.049	2.785
11.	6.031	12.698	31.569	38.999	145.300	37.776	37.968	0.006	2.785
12.	6.637	15.294	33.266	42.800	159.440	39.350	40.056	*******	2.786
13.	7.243	18.136	35.384	46.477	173.170	41.458	42.429	*******	2.787
14.	7.852	21.414	35.585	50.125	186.570	44.853	45.176	*******	2.788
15.	8.461	25.239	38.405	53.858	199.340	46.781	47.748	*******	2.789
16.	9.145	25.256	42.667	55.301	213.240	49.141	48.478	*******	2.790
17.	9.831	27.786	46.668	56.159	226.610	51.667	49.908	0.004	2.791
18.	9.952	17.690	45.399	55.388	228.990	45.551	45.513	0.012	2.792
19.	10.062	21.163	45.096	48.852	231.000	47.904	46.994	0.013	2.792
20.	10.670	29.175	46.094	53.042	242.230	52.041	51.323	0.069	2.793
21.	10.781	19.018	46.569	51.758	244.410	46.702	46.664	0.039	2.793
22.	10.901	22.559	46.307	48.639	246.400	49.056	48.052	*******	2.793
23.	11.509	30.482	47.967	54.264	257.000	53.604	52.622	*******	2.794
24.	11.631	20.476	47.912	53.794	259.060	47.893	47.874	*******	2.794
25.	11.741	24.077	47.420	51.358	260.950	50.072	49.125	*******	2.794
26.	12.348	32.665	49.136	55.617	271.020	55.259	53.617	*******	2.795
27.	12.469	22.028	49.157	56.580	272.980	49.119	49.100	-0.105	2.796
28.	12.579	25.351	48.798	55.356	274.740	50.918	50.199	*******	2.796
29.	12.700	20.035	47.720	55.264	276.590	47.587	47.492	*******	2.796
30.	12.810	22.173	47.172	55.002	278.200	48.423	48.044	*******	2.796
31.	13.416	28.628	48.489	57.743	285.100	52.443	51.858	-0.133	2.797
32.	13.538	20.493	47.943	59.590	285.920	47.773	47.659	-0.107	2.797
33.	13.647	22.754	46.883	60.287	286.500	48.958	48.324	0.003	2.798
34.	14.259	23.095	48.165	59.001	285.430	48.922	48.695	*******	2.799
35.	14.870	23.798	48.766	60.428	281.380	49.277	49.107	0.039	2.800

PLOTS OF A TEST

CARRIED OUT ON THE UNB TANK 2

WITH EXPLOSAFE

TEST NUMBER 7

Q in = 40 kW/m sq

LIQUID LEVEL = 58 %

SET PRESSURE = 25 psig

PRV ORIFICE DIAMETER = 3/8 in.

Date of Test AUG/DEC 1983

TABLE OF CONTENTS

Thermocouple Grid Layout - - - - - - - - - - - - - 3

1. For the Thermocouples Placed in a Vertical Line:

   (a) Plots of Temperature Vs Time - - - - - - - - 4

   (b) Plots of Height Vs. Temperature - - - - - - - 10

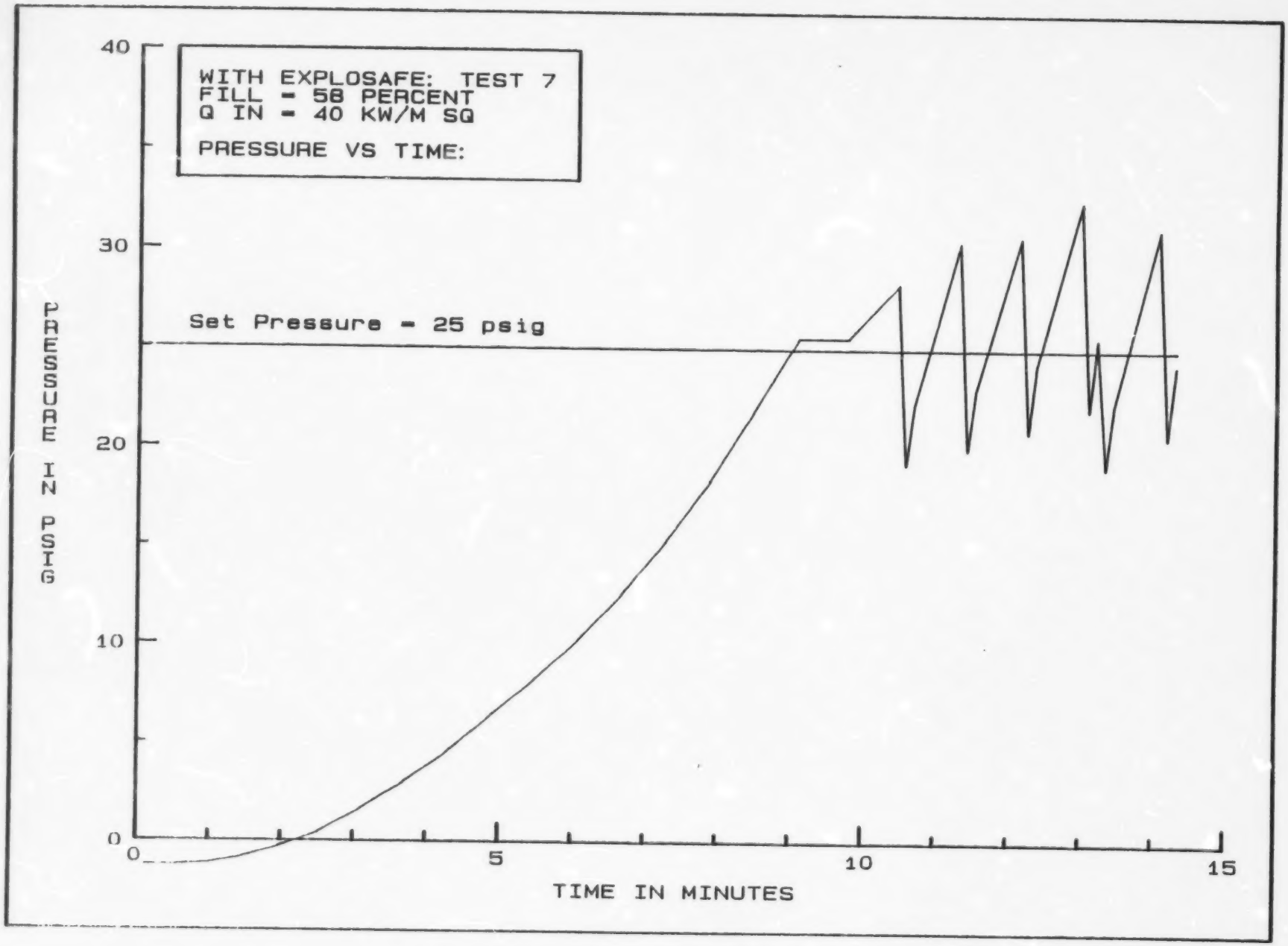
2. Thermocouples Placed in the Four Quadrants in a Vertical Plane: Temp. Vs. Time - - - - - - 18

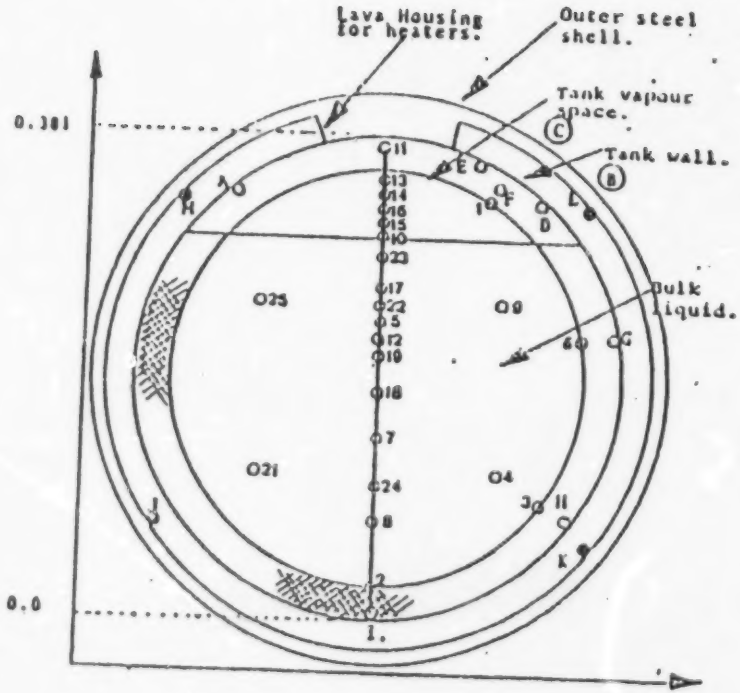
Thermocouple Grid Layout - - - - - - - - - - - - - 20

3. Thermocouples Placed On and Inside the Mild Steel Shell: Temp. Vs. Time - - - - - - - 21

4. Thermocouples Placed in the Lava Medium Temp. Vs. Time - - - - - - - - - - - - - - - - 27

6. Print out of Data - - - - - - - - - - - - - - 29


WITH EXPLOSAFE: TEST 7
FILL = 58 PERCENT
Q IN = 40 KW/M SQ
PRESSURE VS TIME:
Set Pressure = 25 psig
PRESSURE IN PSIG
40
30
20
10
0
0
5
10
15
TIME IN MINUTES



SYMBOL	Thermocouple #	Angle(Deg)
A	26	308
B & D	27 & 29	55 & 55
C & E	28 & 30	25 & 25
G & H	38 & 37	86 & 138
I	34	180
J & K	31 & 36	220 & 135
L & M	33 & 32	50 & 295

Circled thermocouples are ½ the depth of the tank back from thermocouples D & E

Number 41 represents pressure in psig.
Number 42 represents time in seconds.

Thermocouple numbers.	Height (cm)	Angle with the vertical (Deg.)	Doubtful or faulty Thermocouple.
34	0	180	-
02	2.54	-	-
08	12.15	-	-
24	15.55	-	-
07	17.56	-	-
18	20.06	-	-
19	22.6	-	-
12	23.7	-	-
05	24.75	-	-
22	25.4	-	-
17	26.8	-	-
23	28.45	-	-
10	29.9.	-	-
15	30.9	-	-
16	31.9	-	-
14	32.9	-	-
13	33.95	-	-
11	36.5	-	-
1 & 35	-	42	-
6 & 3	-	86 & 138	-
9 & 25	20.35	-	-
4 & 21	12.20	-	-
30 & 28	-	25 & 25	-
29 & 27	-	55 & 55	-
26	-	308	-
38 & 37	-	86 & 138	-
31 & 31	-	135 & 220	-
32 & 33	-	295 & 50	-
20 & 40	Reference temperature	-	-

Fig. III.C A grid layout of thermocouples for an Explosafe equipped vessel. (Valid for 74, 58 and 23 percent liquid full cases)

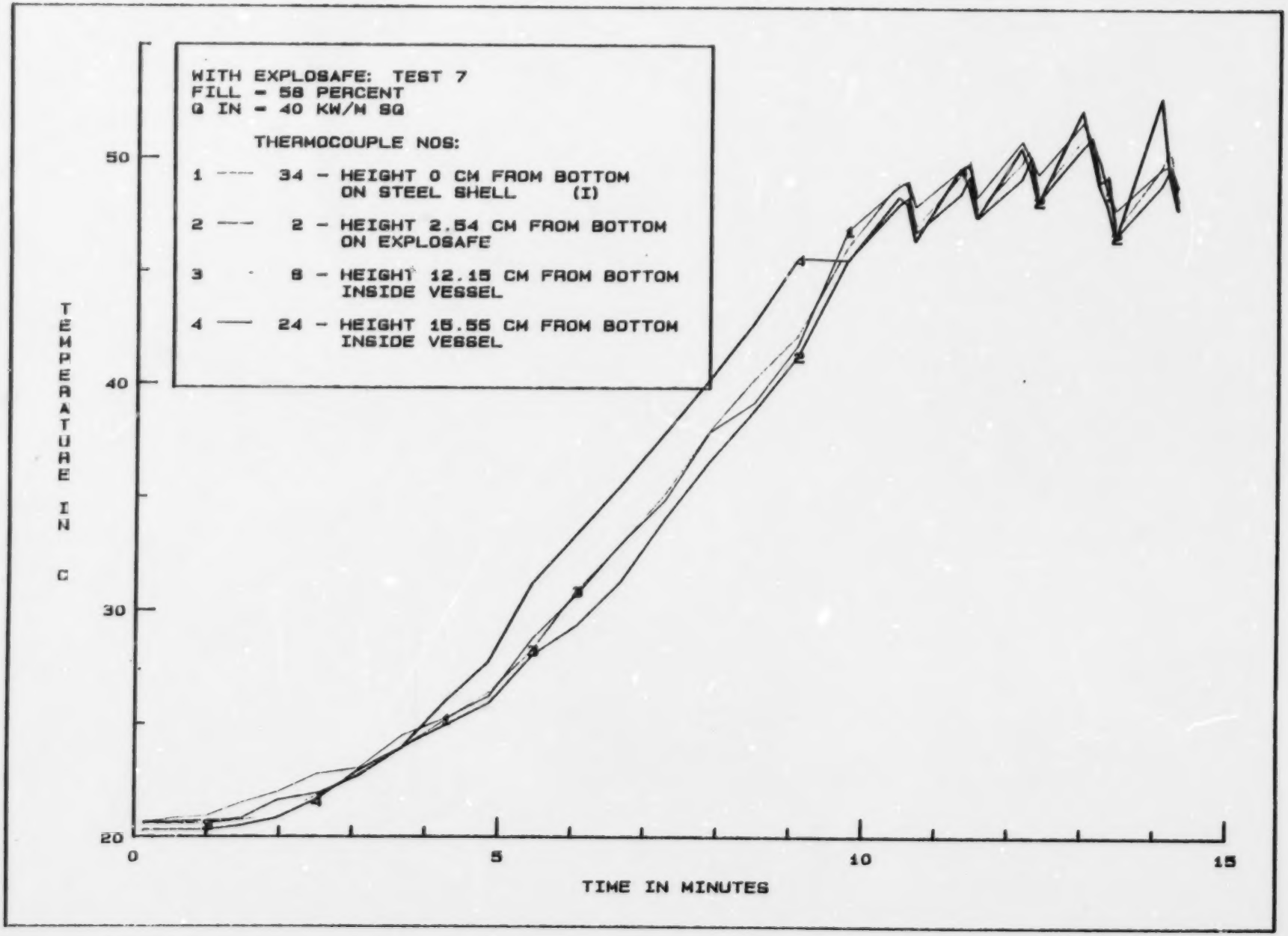
FOLLOWING THERMOCOUPLES ARE PLACED

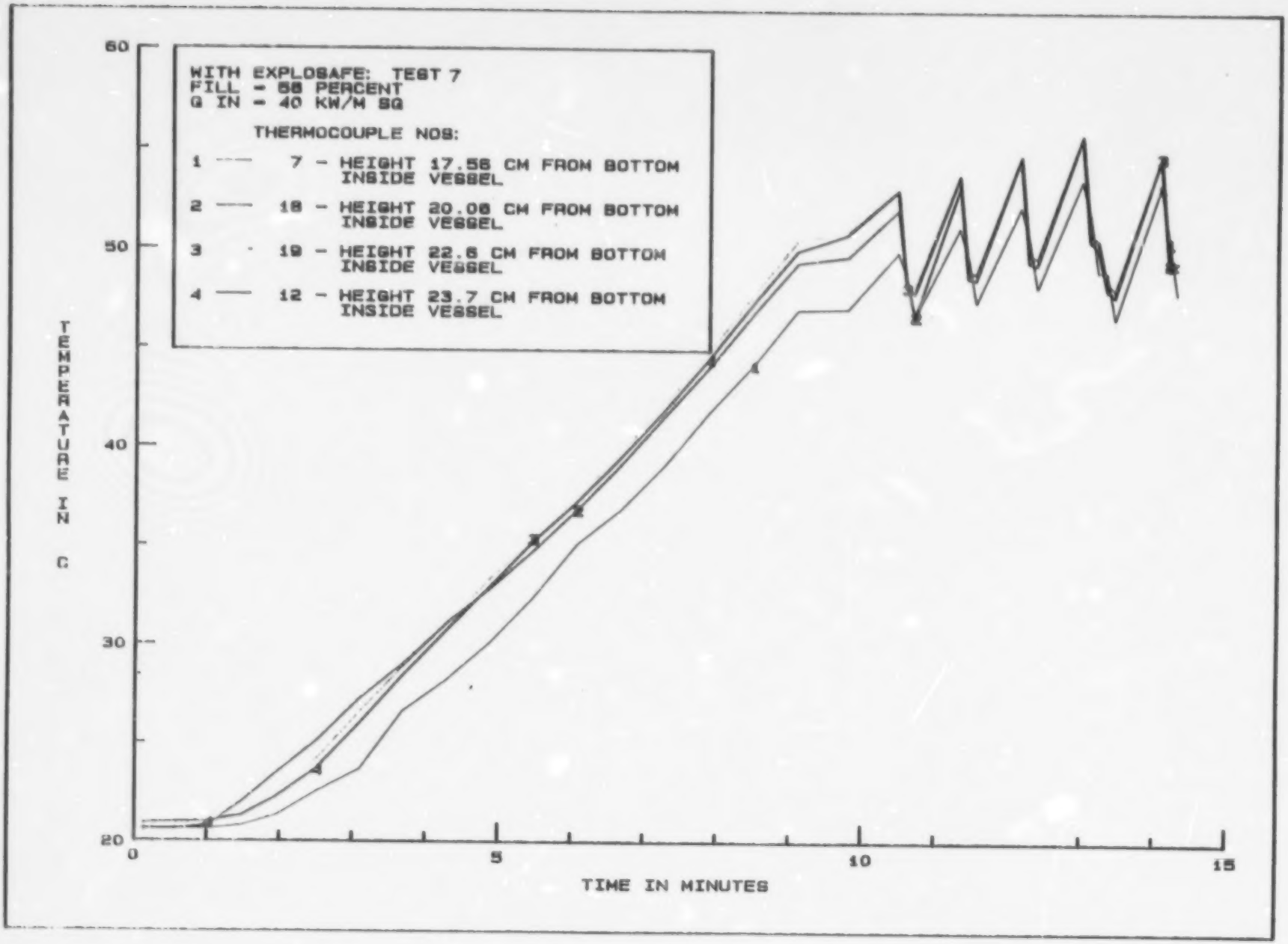
AT THE CENTRE OF THE VESSEL (DIA. 33.1 CM)

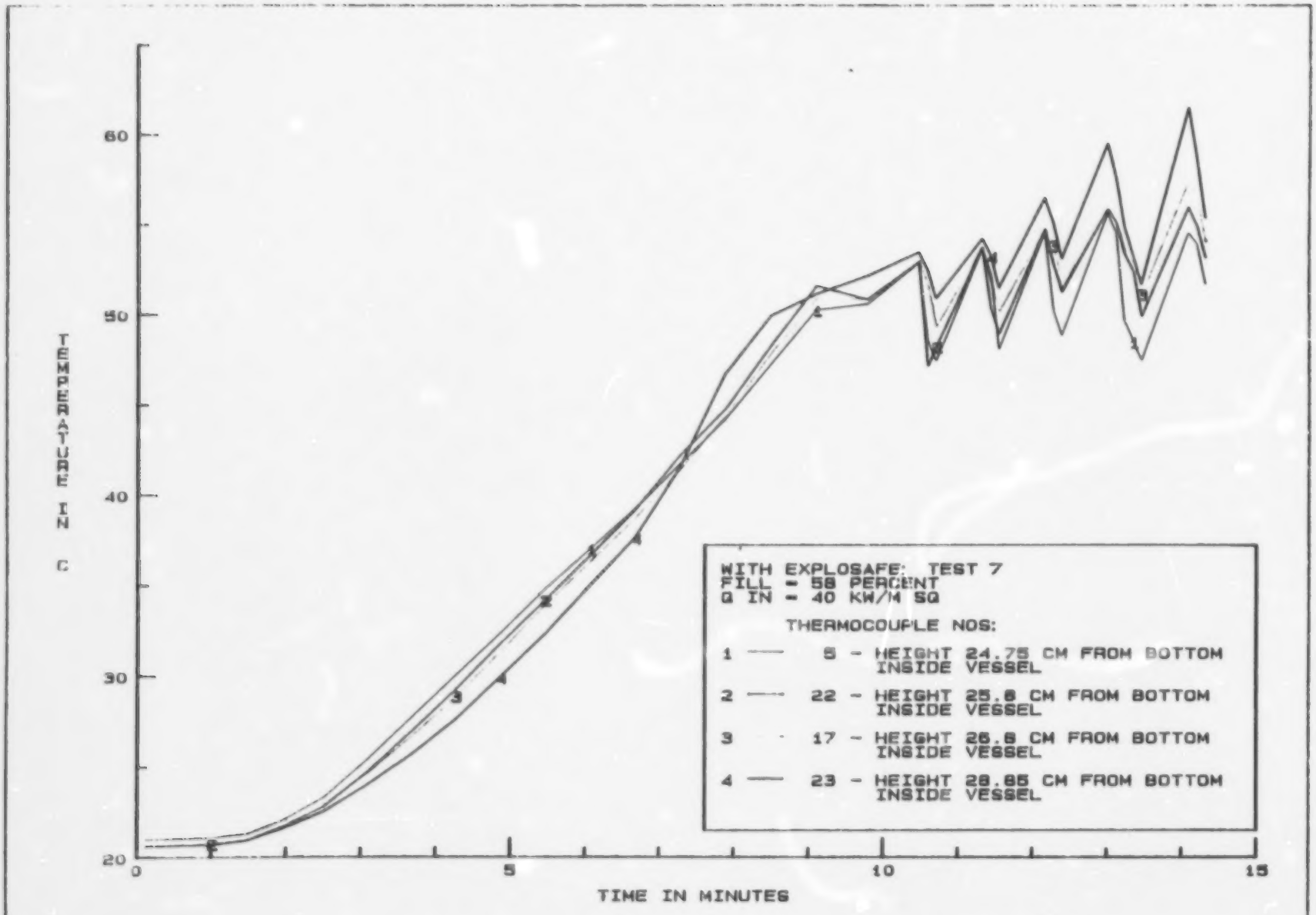
IN A VERTICLE AXIS

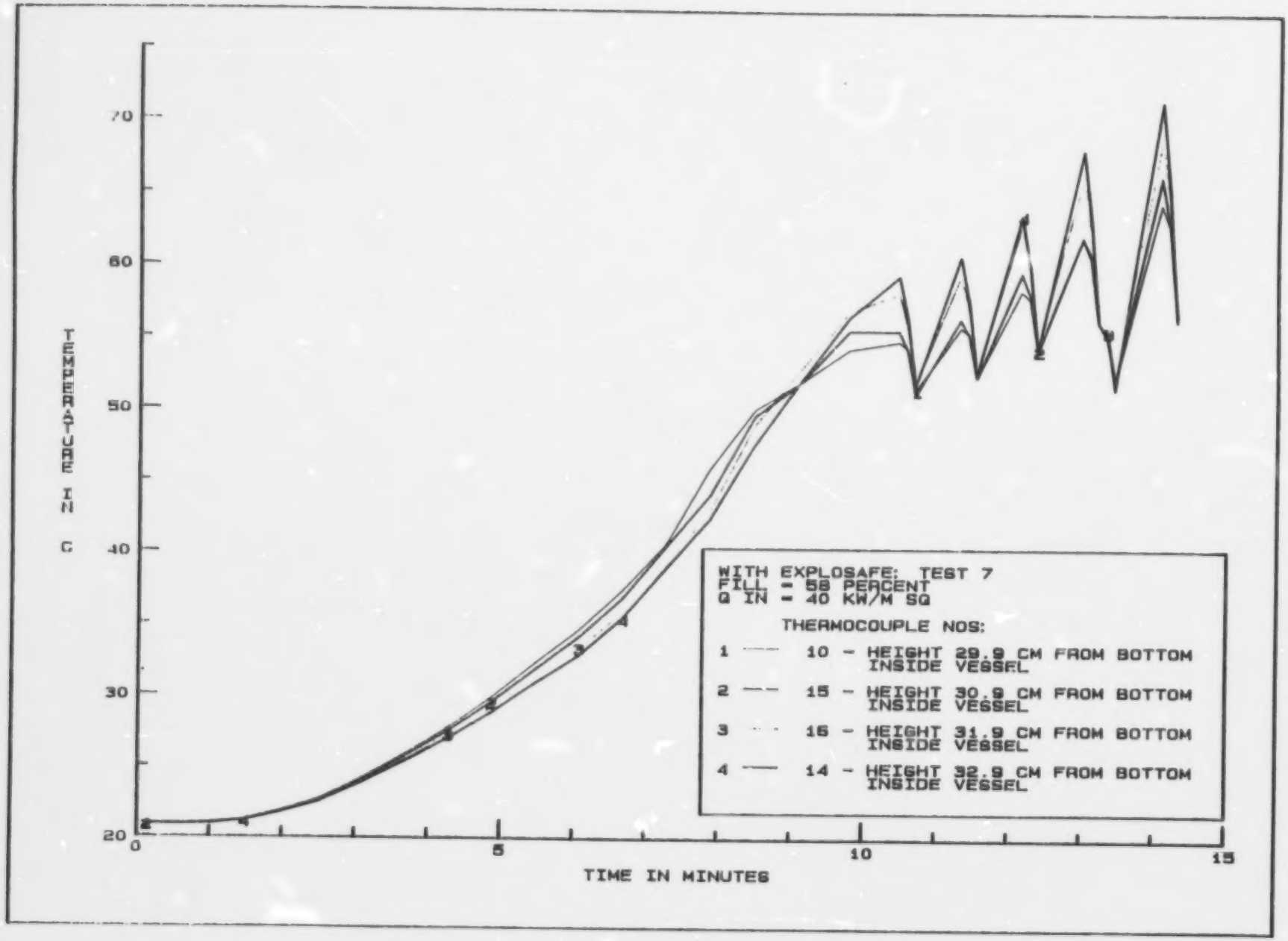
THERMOCOUPLE NUM.	HEIGHT FROM BOTTOM IN CM
34 OR I	0
2	2.54
8	12.15
24	15.55
7	17.56
19	20.06
18	22.6
12	23.7
5	24.75
22	25.9
17	26.8
23	28.85
10	29.9
15	30.9
16	31.9
14	32.9
13	33.95
11	36.5

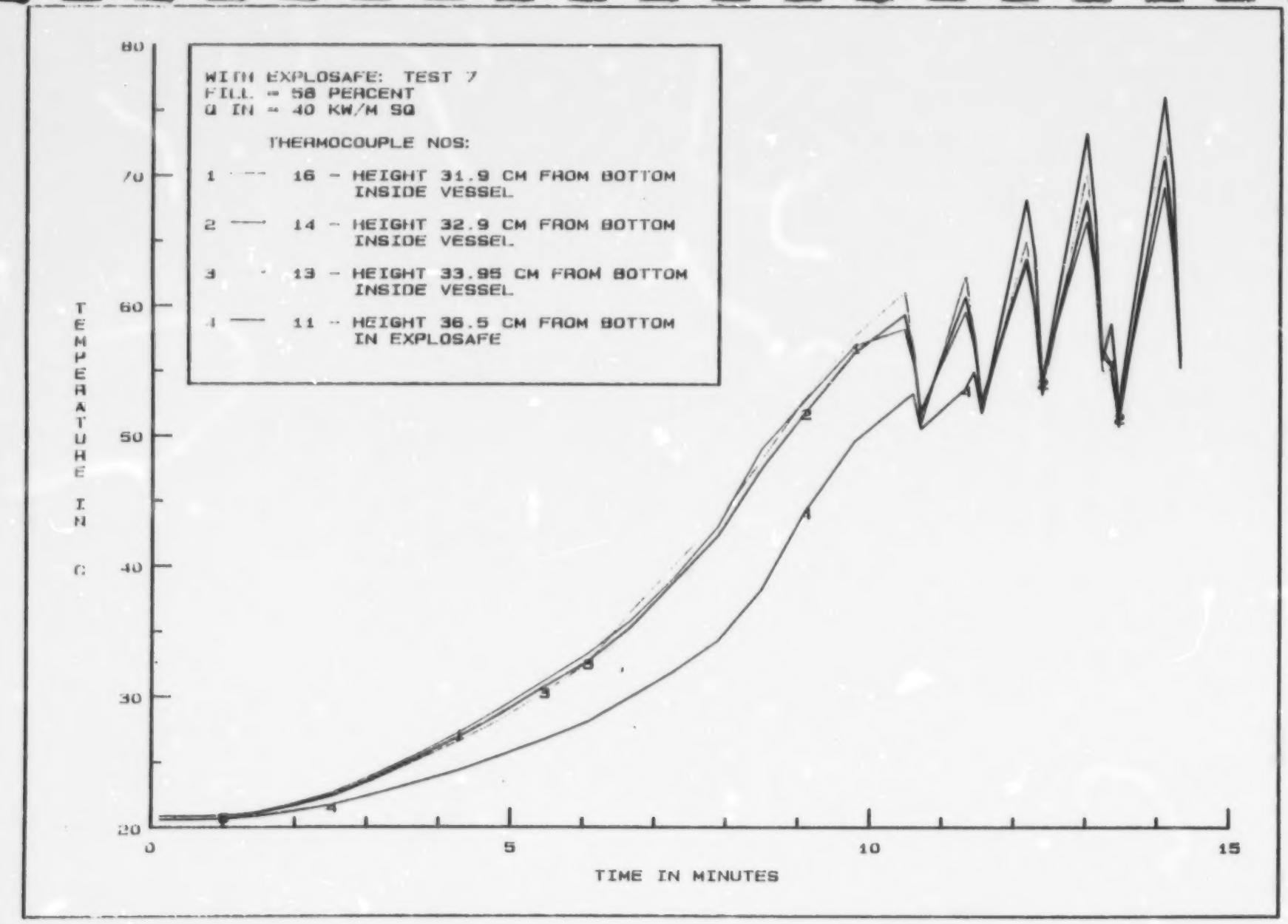
PLOTS ARE GIVEN PER PAGE


WITH EXPLOSAFE: TEST 7
FILL - 58 PERCENT
Q IN - 40 KW/M SQ
THERMOCOUPLE NOS:
1 ---- 34 - HEIGHT 0 CM FROM BOTTOM ON STEEL SHELL (I)
2 ---- 2 - HEIGHT 2.54 CM FROM BOTTOM ON EXPLOSAFE
3 8 - HEIGHT 12.15 CM FROM BOTTOM INSIDE VESSEL
4 ---- 24 - HEIGHT 15.55 CM FROM BOTTOM INSIDE VESSEL
TEMPERATURE IN C
50
40
30
20
0
5
10
15
TIME IN MINUTES


WITH EXPLOSAFE: TEST 7
FILL - 58 PERCENT
Q IN - 40 KW/M SQ
THERMOCOUPLE NOS:
1 —— 7 - HEIGHT 17.56 CM FROM BOTTOM INSIDE VESSEL
2 —— 18 - HEIGHT 20.08 CM FROM BOTTOM INSIDE VESSEL
3 19 - HEIGHT 22.6 CM FROM BOTTOM INSIDE VESSEL
4 —— 12 - HEIGHT 23.7 CM FROM BOTTOM INSIDE VESSEL
TEMPERATURE IN C
60
50
40
30
20
0
5
10
15
TIME IN MINUTES


TEMPERATURE IN C
60
50
40
30
20
0
5
10
15
TIME IN MINUTES
WITH EXPLOSAFE: TEST 7
FILL - 58 PERCENT
Q IN - 40 KW/M SQ
THERMOCOUPLE NOS:
1 —— 5 - HEIGHT 24.75 CM FROM BOTTOM INSIDE VESSEL
2 —— 22 - HEIGHT 25.8 CM FROM BOTTOM INSIDE VESSEL
3 17 - HEIGHT 26.8 CM FROM BOTTOM INSIDE VESSEL
4 —— 23 - HEIGHT 28.85 CM FROM BOTTOM INSIDE VESSEL


70
60
50
40
30
20
TEMPERATURE IN C
0
5
10
15
TIME IN MINUTES
WITH EXPLOSAFE: TEST 7
FILL = 58 PERCENT
Q IN = 40 KW/M SQ
THERMOCOUPLE NOS:
1 —— 10 - HEIGHT 29.9 CM FROM BOTTOM INSIDE VESSEL
2 —— 15 - HEIGHT 30.9 CM FROM BOTTOM INSIDE VESSEL
3 - - - 16 - HEIGHT 31.9 CM FROM BOTTOM INSIDE VESSEL
4 —— 14 - HEIGHT 32.9 CM FROM BOTTOM INSIDE VESSEL


WITH EXPLOSAFE: TEST 7
FILL = 58 PERCENT
Q IN = 40 KW/M SQ
THERMOCOUPLE NOS:
1 --- 16 - HEIGHT 31.9 CM FROM BOTTOM INSIDE VESSEL
2 —— 14 - HEIGHT 32.9 CM FROM BOTTOM INSIDE VESSEL
3 · 13 - HEIGHT 33.95 CM FROM BOTTOM INSIDE VESSEL
4 —— 11 - HEIGHT 36.5 CM FROM BOTTOM IN EXPLOSAFE
TEMPERATURE IN C
80
70
60
50
40
30
20
0
5
10
15
TIME IN MINUTES

FOLLOWING ARE HEIGHT VS TEMPERATURE

PLOTS FOR THE

THERMOCOUPLES PLACED AT THE CENTRE

OF THE VESSEL

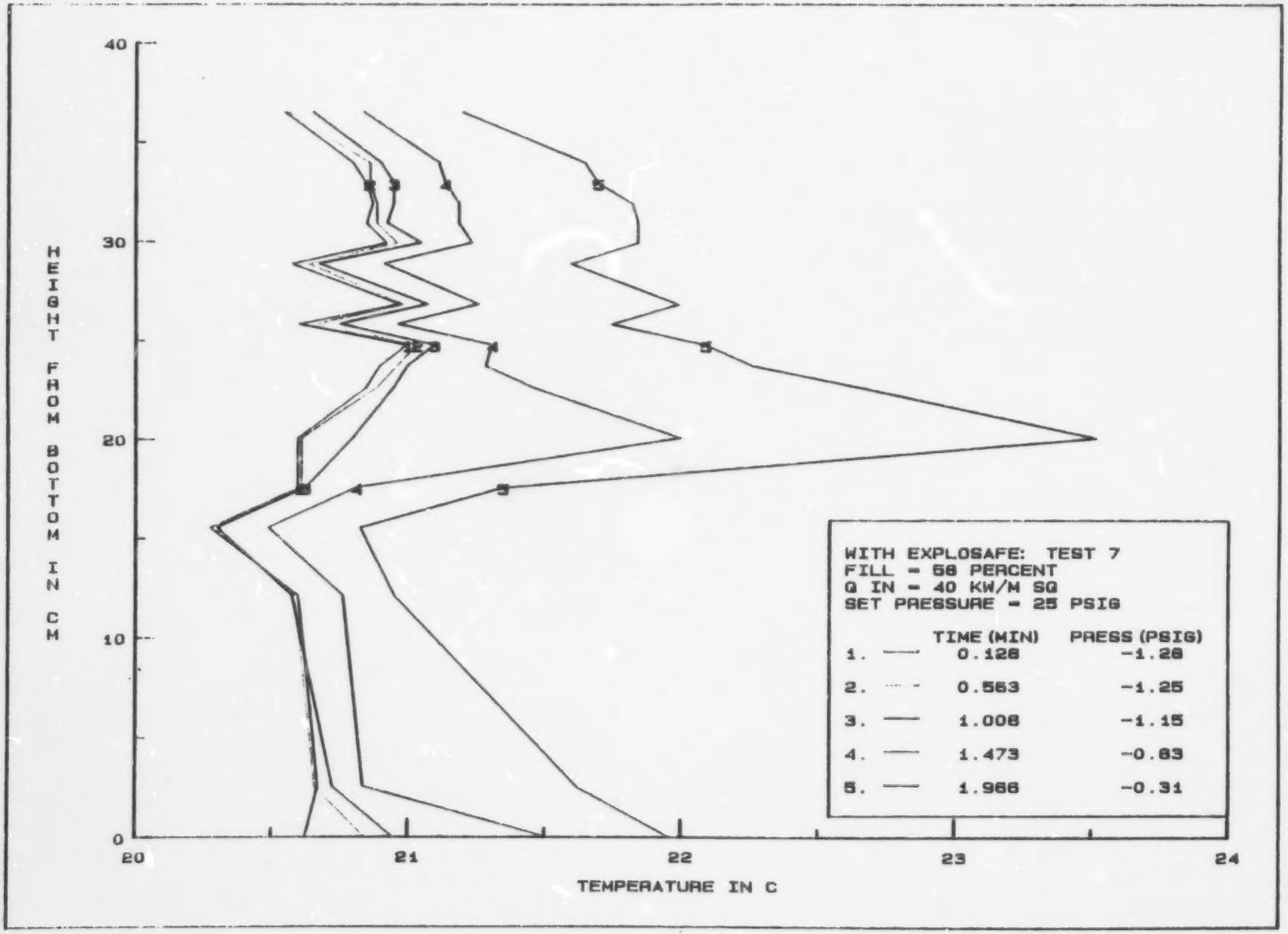
IN A VERTICAL AXIS

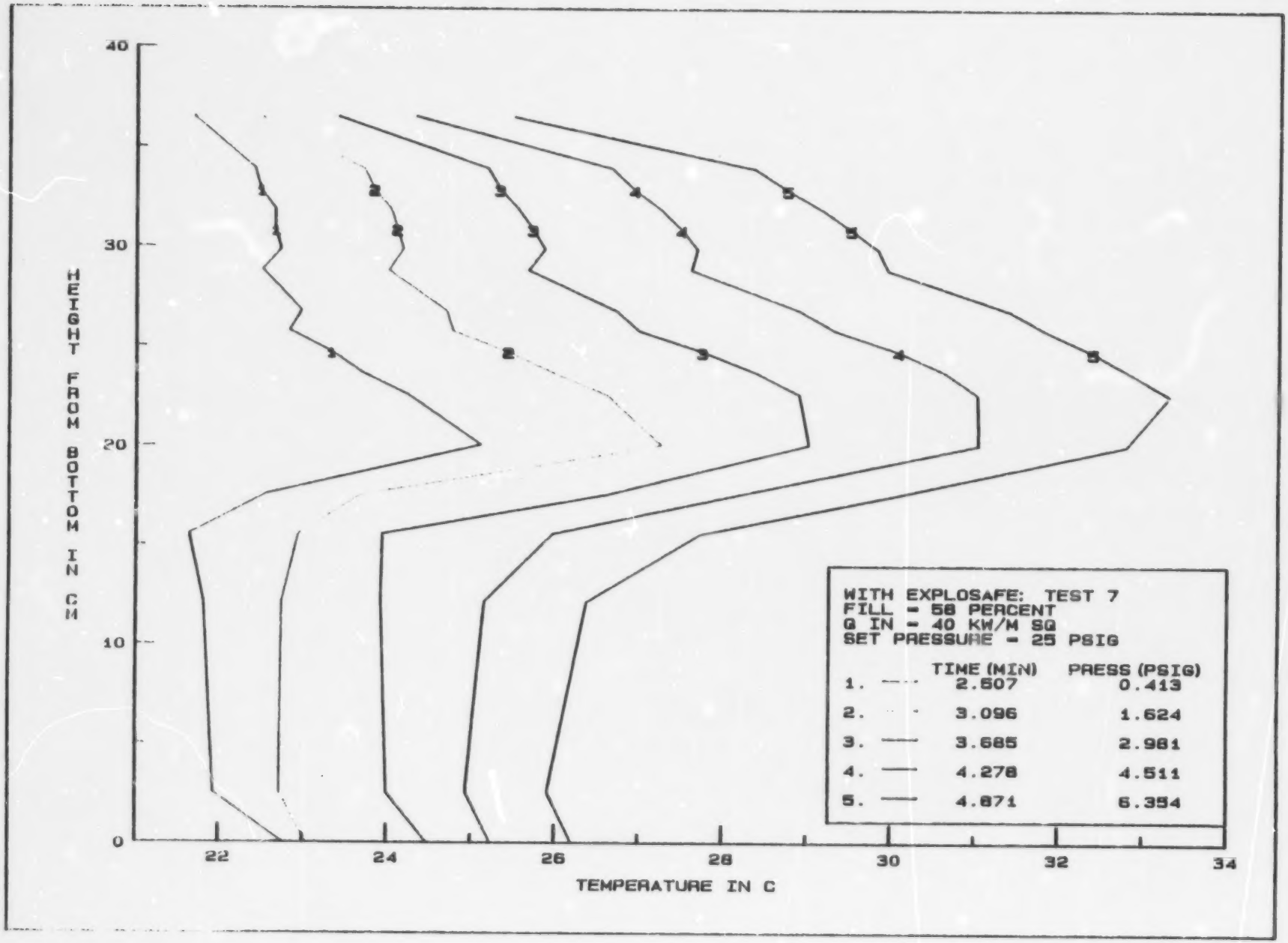
EACH PLOT REPRESENTS ONE SCAN OF

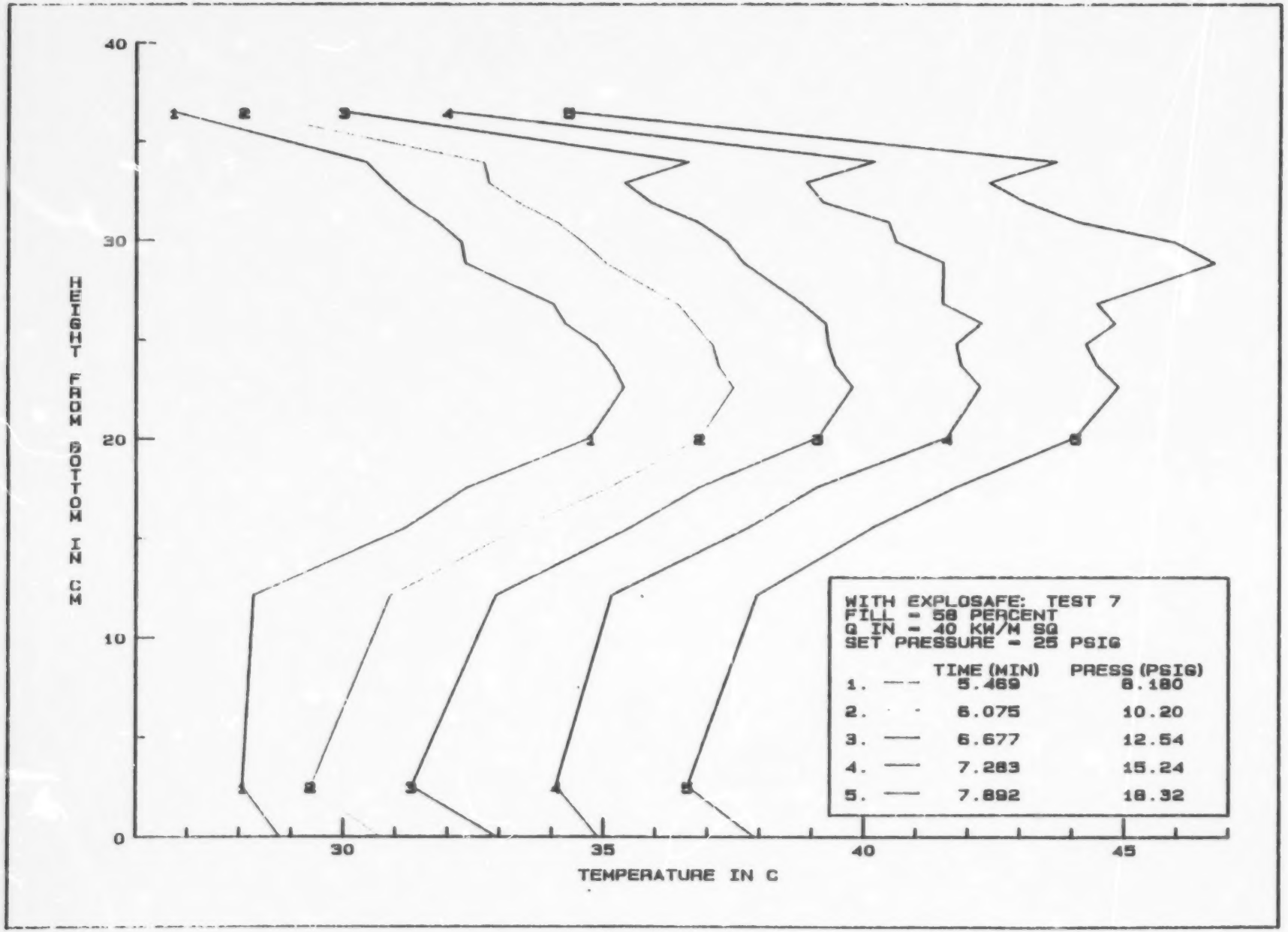
ALL THE THERMOCOUPLES

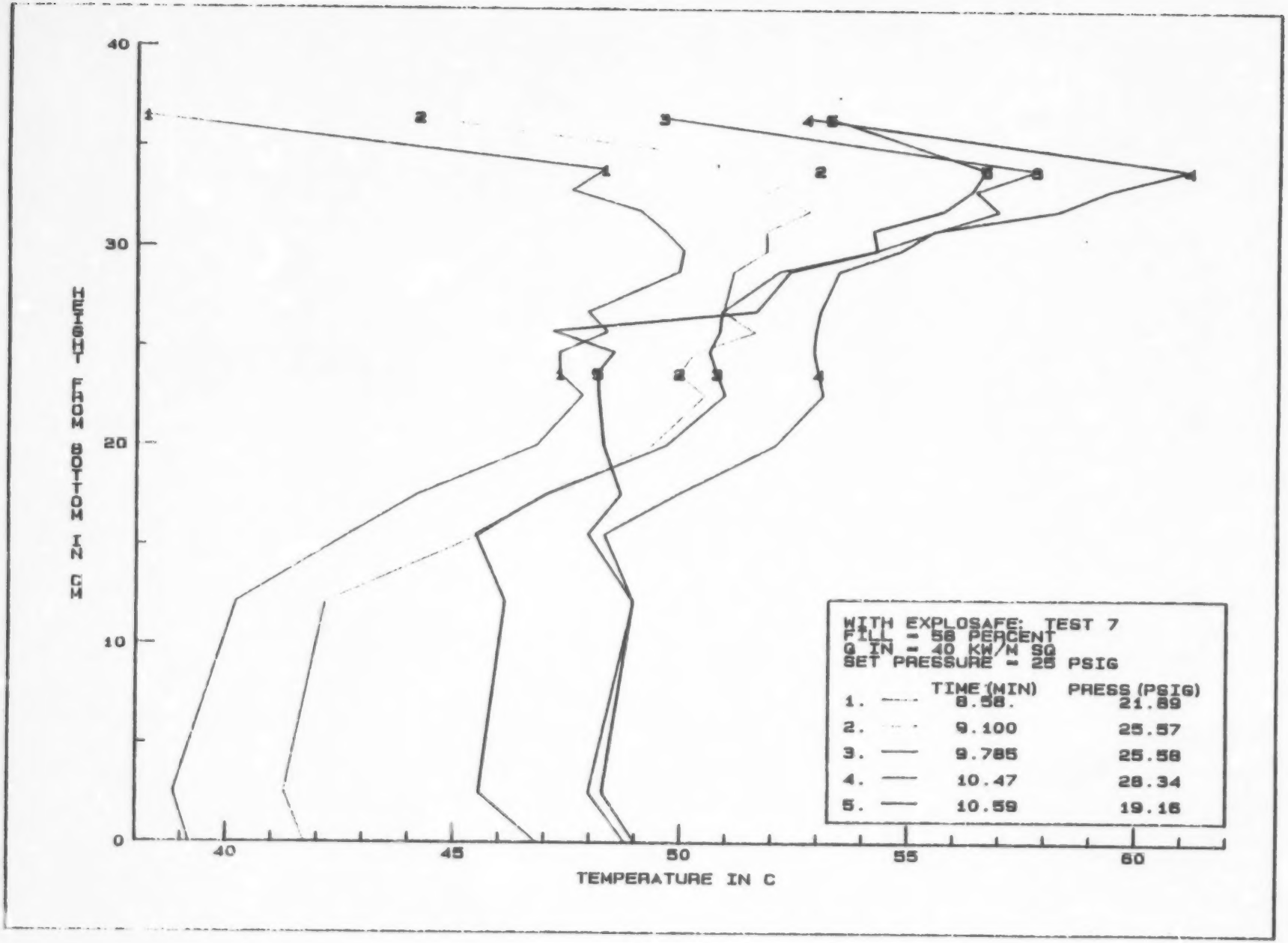
PLOTS ARE GIVEN AS FIVE (5) SCANS

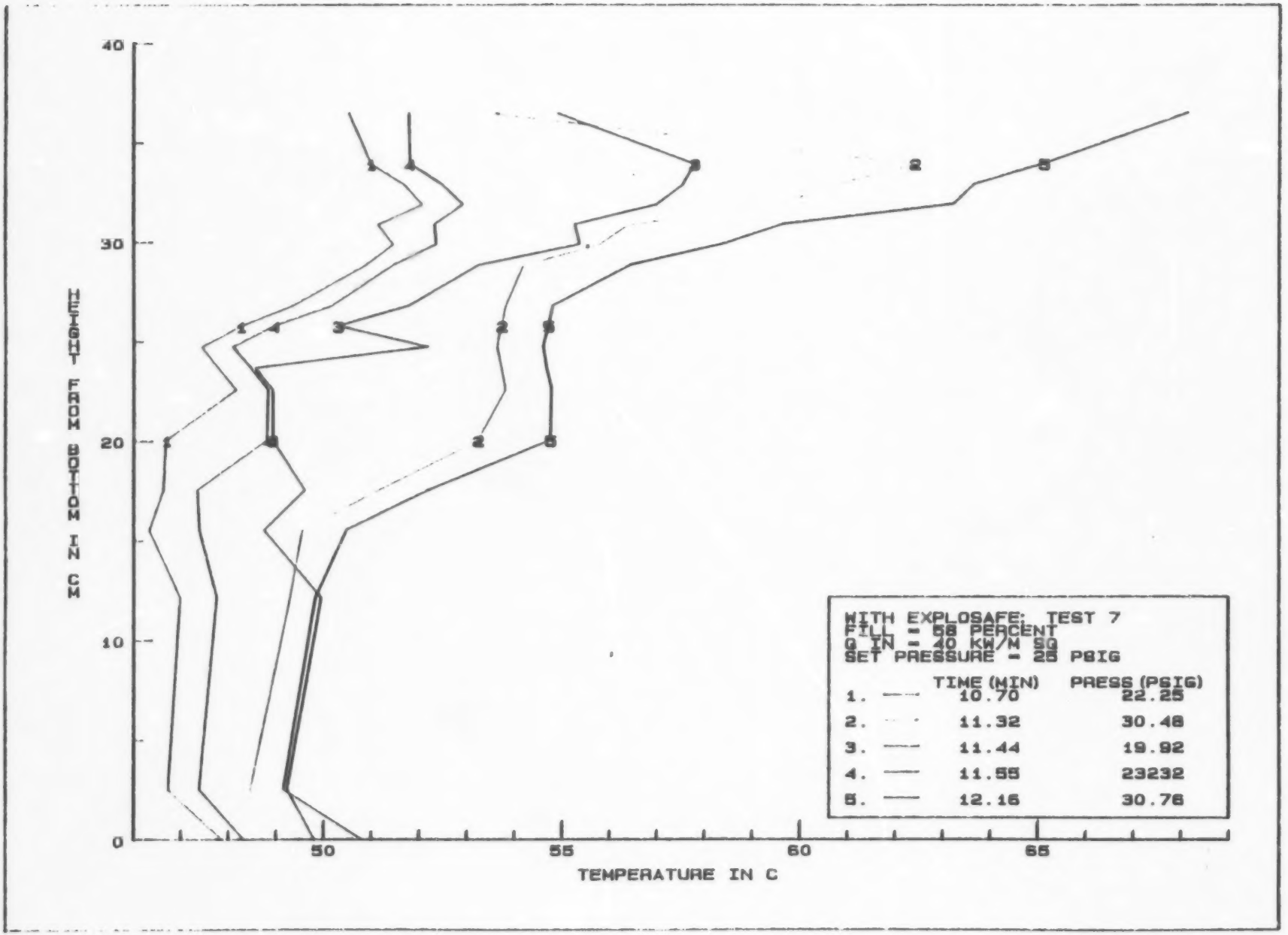
PER PAGE

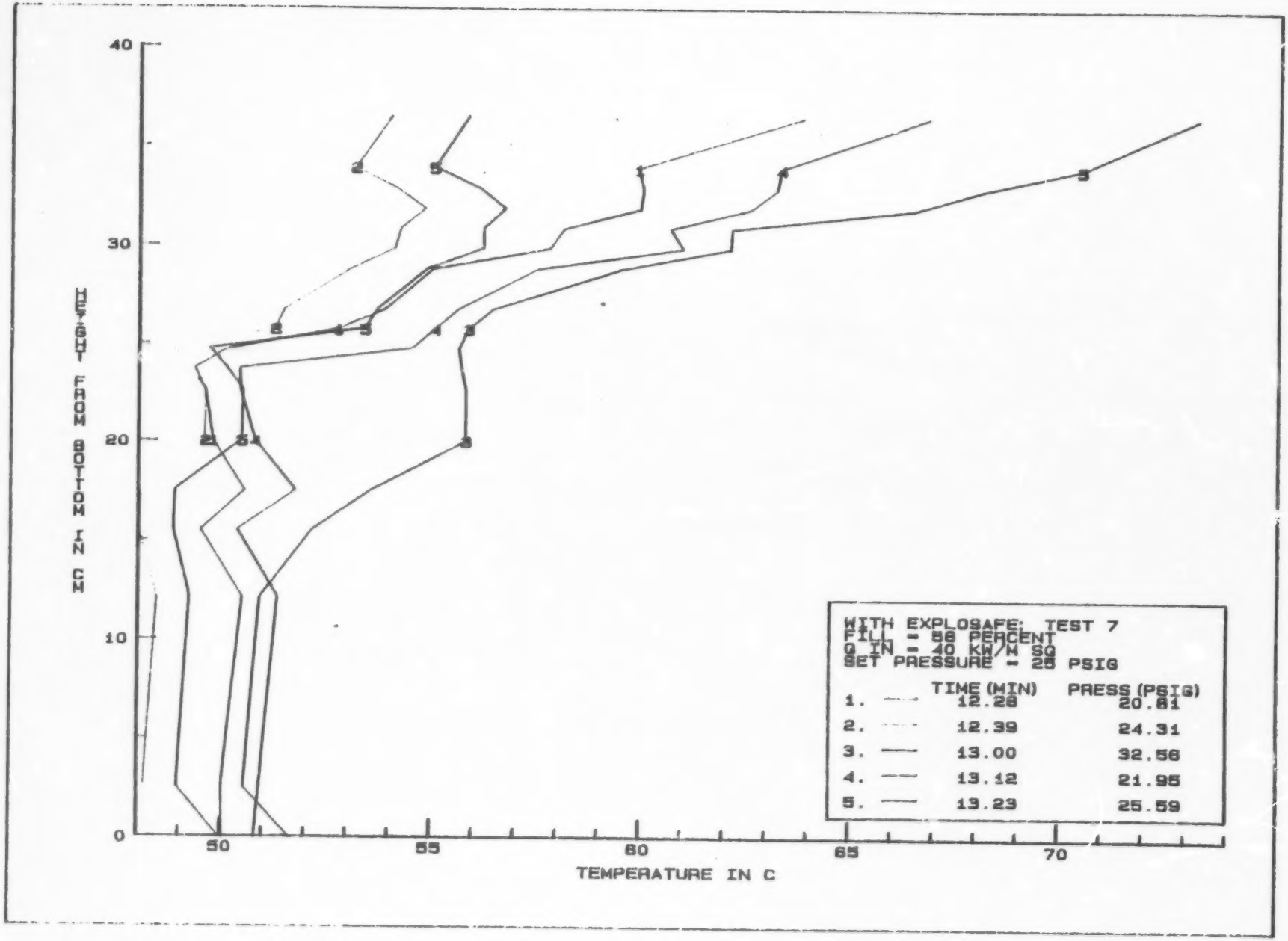

HEIGHT FROM BOTTOM IN CM
0
10
20
30
40
20
21
22
23
24
TEMPERATURE IN C
WITH EXPLOSAFE: TEST 7
FILL = 58 PERCENT
Q IN = 40 KW/M SQ
SET PRESSURE = 25 PSIG
TIME (MIN) PRESS (PSIG)
1. 0.128 -1.28
2. 0.563 -1.25
3. 1.008 -1.15
4. 1.473 -0.83
5. 1.966 -0.31

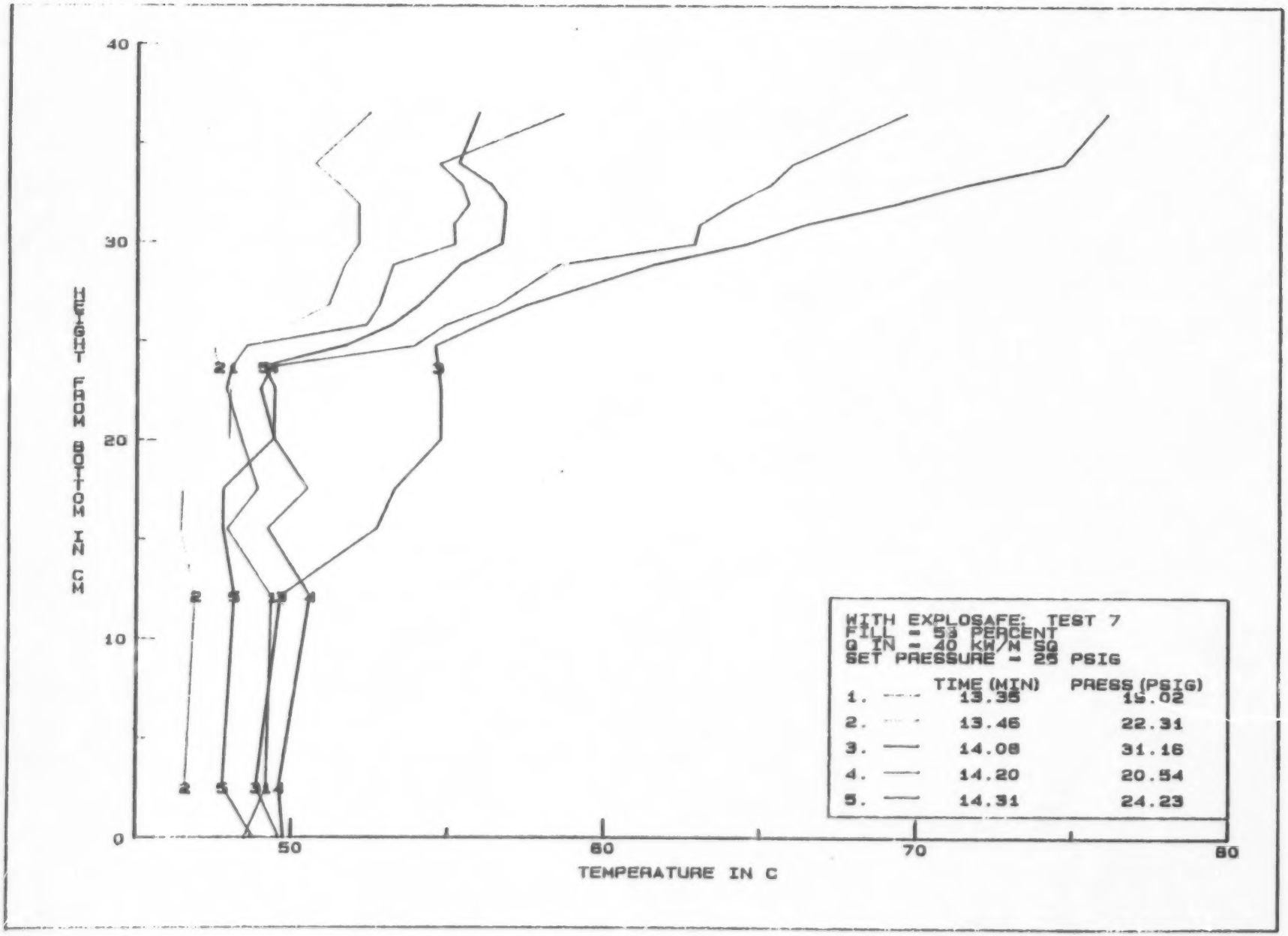

HEIGHT FROM BOTTOM IN CM
40
30
20
10
0
22
24
26
28
30
32
34
TEMPERATURE IN C
WITH EXPLOSAFE: TEST 7
FILL = 58 PERCENT
Q IN = 40 KW/M SQ
SET PRESSURE = 25 PSIG
TIME (MIN) PRESS (PSIG)
1. 2.507 0.413
2. 3.096 1.624
3. 3.685 2.981
4. 4.278 4.511
5. 4.871 6.354


HEIGHT FROM BOTTOM IN CM
TEMPERATURE IN C
0
10
20
30
40
30
35
40
45
WITH EXPLOSAFE: TEST 7
FILL = 58 PERCENT
Q IN = 40 KW/M SQ
SET PRESSURE = 25 PSIG
TIME (MIN) PRESS (PSIG)
1. 5.469 8.180
2. 6.075 10.20
3. 6.677 12.54
4. 7.283 15.24
5. 7.892 18.32


HEIGHT FROM BOTTOM IN CM
TEMPERATURE IN C
WITH EXPLOSAFE: TEST 7
FILL = 58 PERCENT
Q IN = 40 KW/M SQ
SET PRESSURE = 25 PSIG
TIME (MIN) PRESS (PSIG)
1. 8.58. 21.89
2. 9.100 25.57
3. 9.785 25.58
4. 10.47 28.34
5. 10.59 19.16

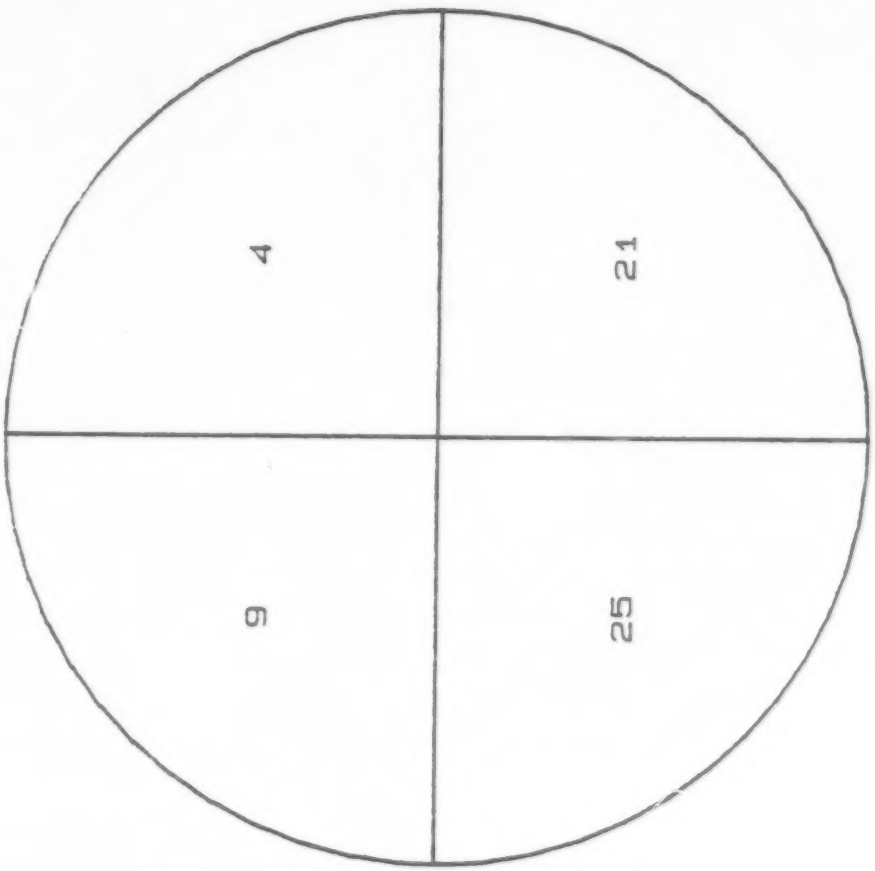

HEIGHT FROM BOTTOM IN CM
40
30
20
10
0
50
55
60
65
TEMPERATURE IN C
WITH EXPLOSAFE: TEST 7
FILL = 58 PERCENT
Q IN = 40 KW/M SQ
SET PRESSURE = 25 PSIG
TIME (MIN) PRESS (PSIG)
1. 10.70 22.25
2. 11.32 30.48
3. 11.44 19.92
4. 11.55 23232
5. 12.16 30.76


HEIGHT FROM BOTTOM IN CM
TEMPERATURE IN C
0
10
20
30
40
50
55
60
65
70
WITH EXPLOSAFE: TEST 7
FILL = 58 PERCENT
Q IN = 40 KW/M SQ
SET PRESSURE = 25 PSIG
TIME (MIN) PRESS (PSIG)
1. 12.28 20.81
2. 12.39 24.31
3. 13.00 32.56
4. 13.12 21.95
5. 13.23 25.59


HEIGHT FROM BOTTOM IN CM
40
30
20
10
0
50
60
70
80
TEMPERATURE IN C
WITH EXPLOSAFE: TEST 7
FILL = 53 PERCENT
Q IN = 40 KW/M SQ
SET PRESSURE = 25 PSIG
TIME (MIN) PRESS (PSIG)
1. 13.35 15.02
2. 13.46 22.31
3. 14.08 31.16
4. 14.20 20.54
5. 14.31 24.23

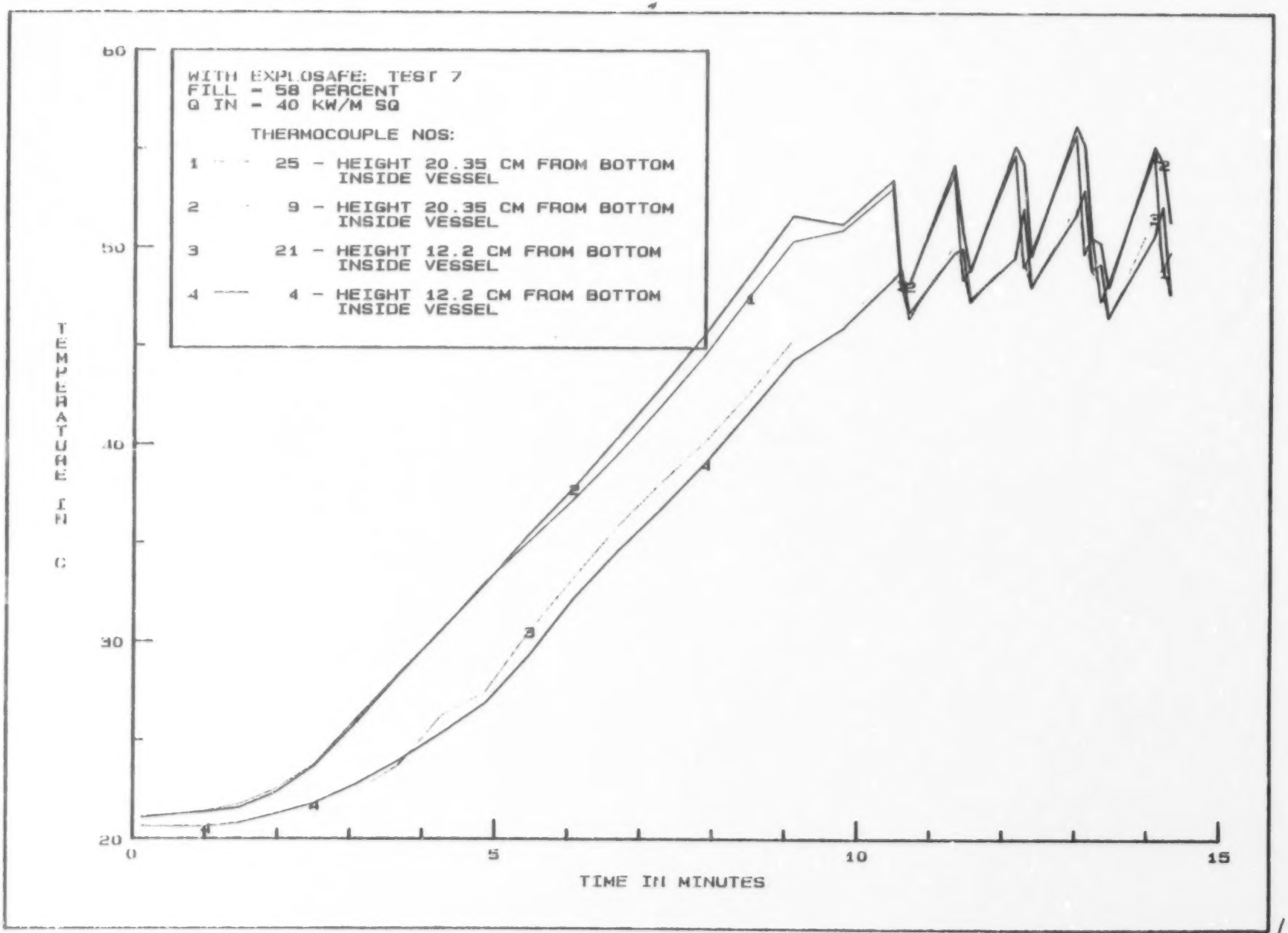
FOLLOWING FOUR THERMOCOUPLES ARE PLACED

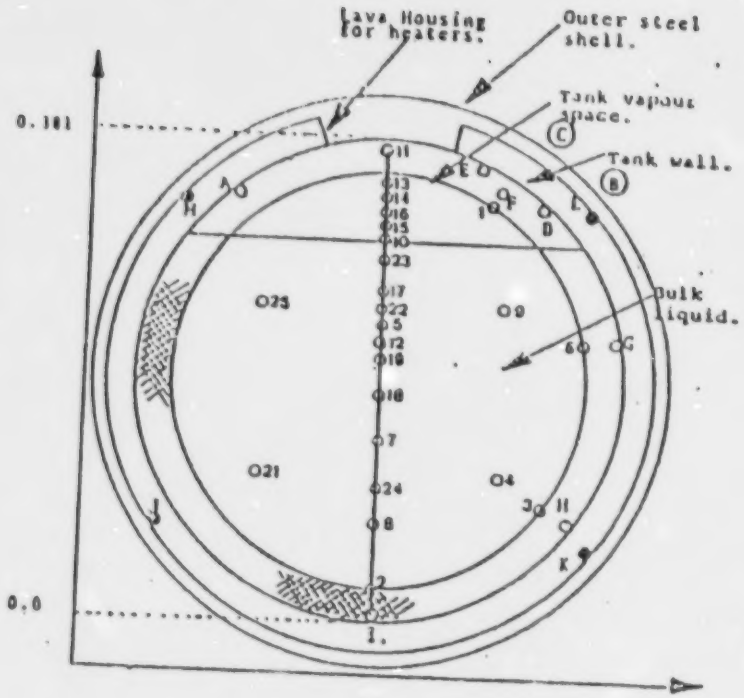
AT THE FOUR QUADRANTS ON A VERTICAL PLANE



THERMOCOUPLE NUM.	HEIGHT FROM BOTTOM IN CM
9 AND 25	20.35
4 AND 21	12.2

PLOTS ARE GIVEN PER PAGE


WITH EXPLOSAFE: TEST 7
FILL - 58 PERCENT
Q IN - 40 KW/M SQ
THERMOCOUPLE NOS:
1 - 25 - HEIGHT 20.35 CM FROM BOTTOM INSIDE VESSEL
2 - 9 - HEIGHT 20.35 CM FROM BOTTOM INSIDE VESSEL
3 - 21 - HEIGHT 12.2 CM FROM BOTTOM INSIDE VESSEL
4 - 4 - HEIGHT 12.2 CM FROM BOTTOM INSIDE VESSEL
60
50
40
30
20
TEMPERATURE IN C
0
5
10
15
TIME IN MINUTES



SYMBOL	Thermocouple #	Angle(Deg)
A	26	308
B & D	27 & 29	55 & 55
C & E	28 & 30	25 & 25
G & H	38 & 37	86 & 138
I	34	180
J & K	31 & 36	220 & 135
L & M	33 & 32	50 & 295

Circled thermocouples are ½ the depth of the tank back from thermocouples D & E

Number 41 represents pressure in psig.
Number 42 represents time in seconds.

Thermocouple numbers.	Height (cm)	Angle with the vertical (Deg.)	Doubtful or faulty Thermocouple.
34	0	180	-
02	2.54	-	-
08	12.15	-	-
24	15.55	-	-
07	17.56	-	-
18	20.06	-	-
19	22.6	-	-
12	23.7	-	-
05	24.75	-	-
22	25.8	-	-
17	26.8	-	-
23	28.85	-	-
10	29.9	-	-
15	30.9	-	-
16	31.9	-	-
14	32.9	-	-
13	33.95	-	-
11	36.5	-	-
1 & 35	-	42	-
6 & 3	-	86 & 138	-
9 & 25	20.35	-	-
4 & 21	12.20	-	-
30 & 28	-	25 & 25	-
29 & 27	-	55 & 55	-
26	-	308	-
38 & 37	-	86 & 138	-
36 & 31	-	135 & 220	-
32 & 33	-	295 & 50	-
20 & 40	Reference temperature	-	-

Fig. III.C A grid layout of thermocouples for an Explosafe equipped vessel. (Valid for 74, 58 and 23 percent liquid full cases)

FOLLOWING THERMOCOUPLES ARE PLACED

ON EXPLOSAFE OR

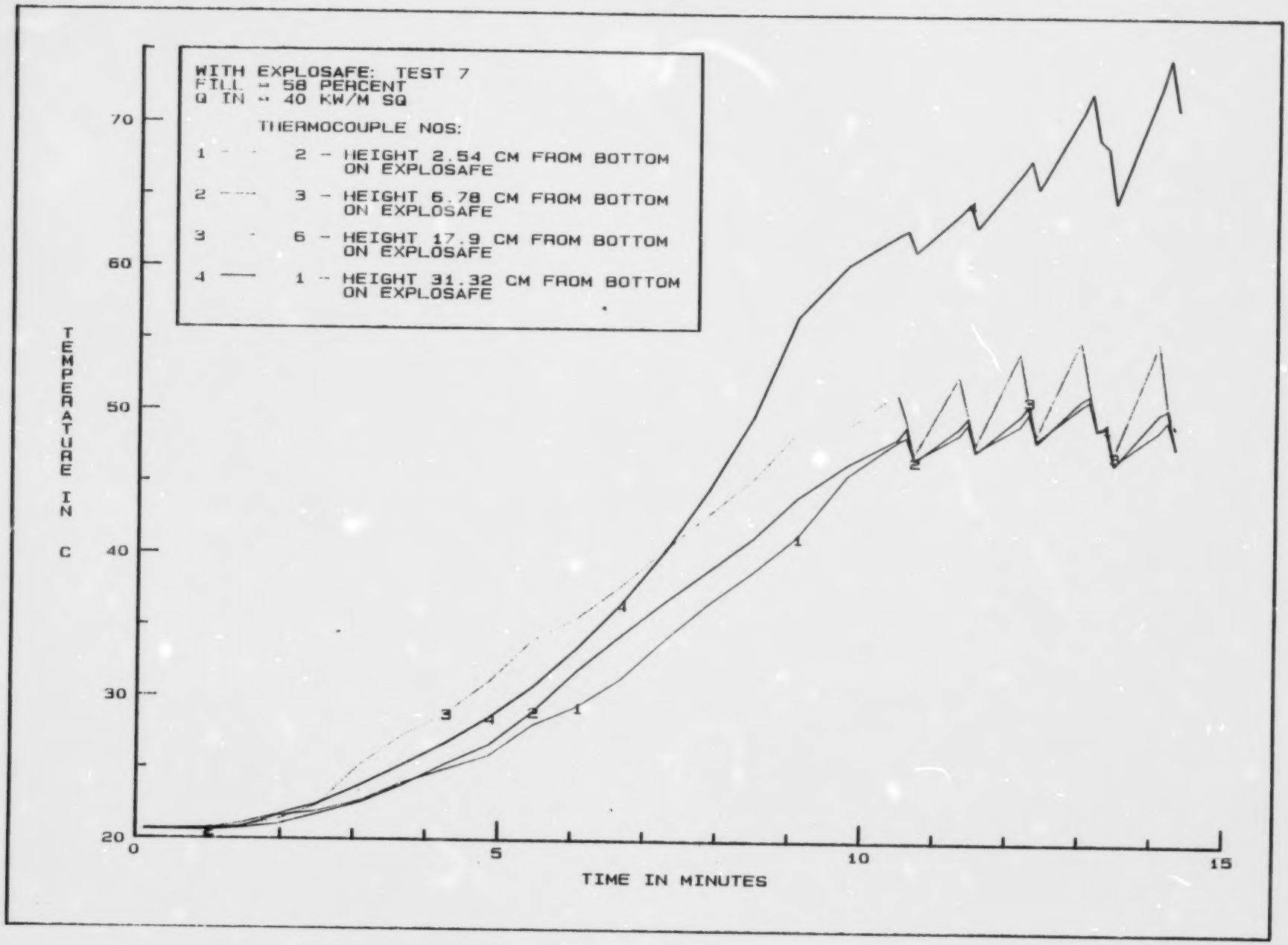
INSIDE EXPLOSAFE OR

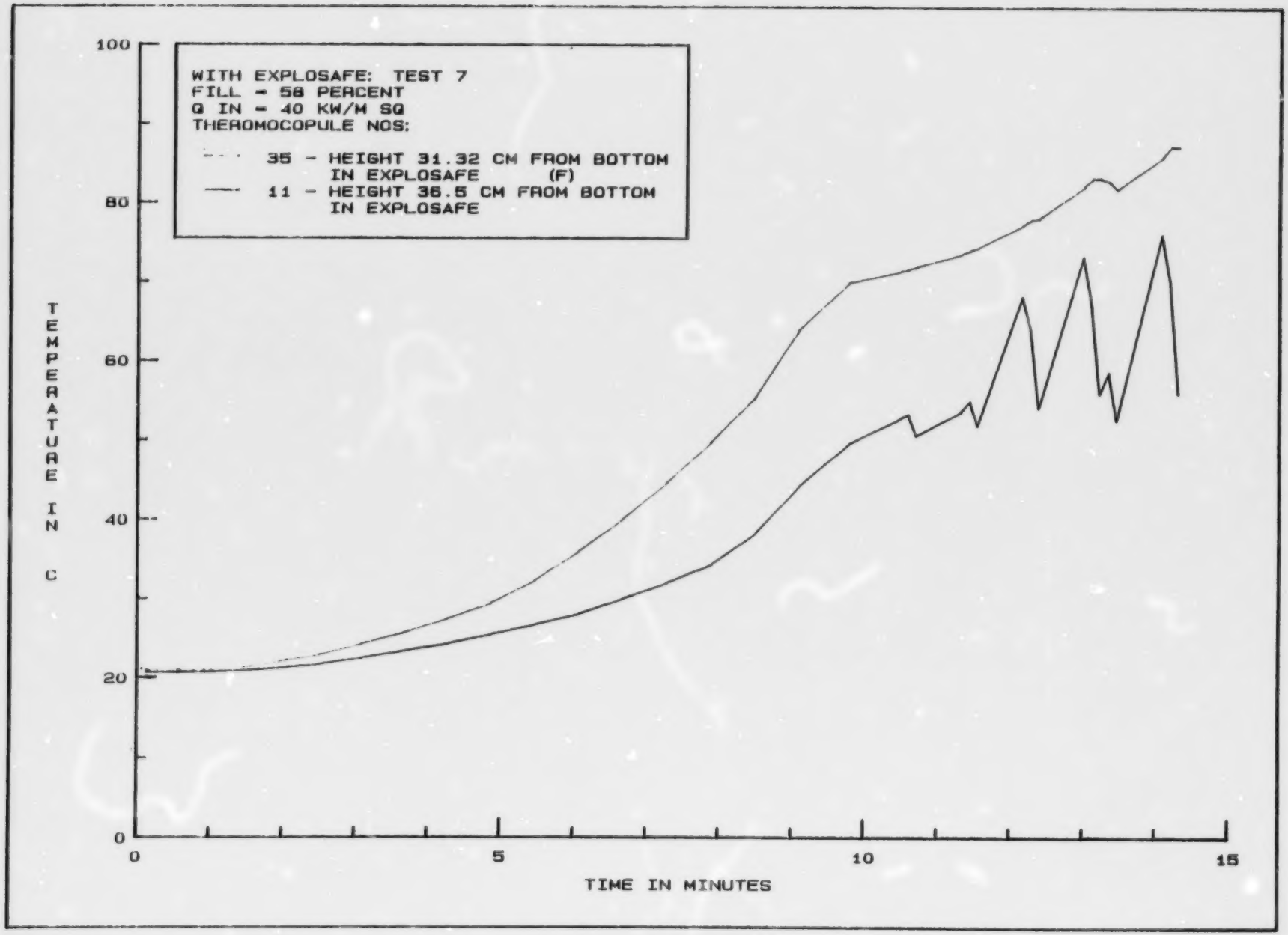
ON THE MILD STEEL SHELL OR

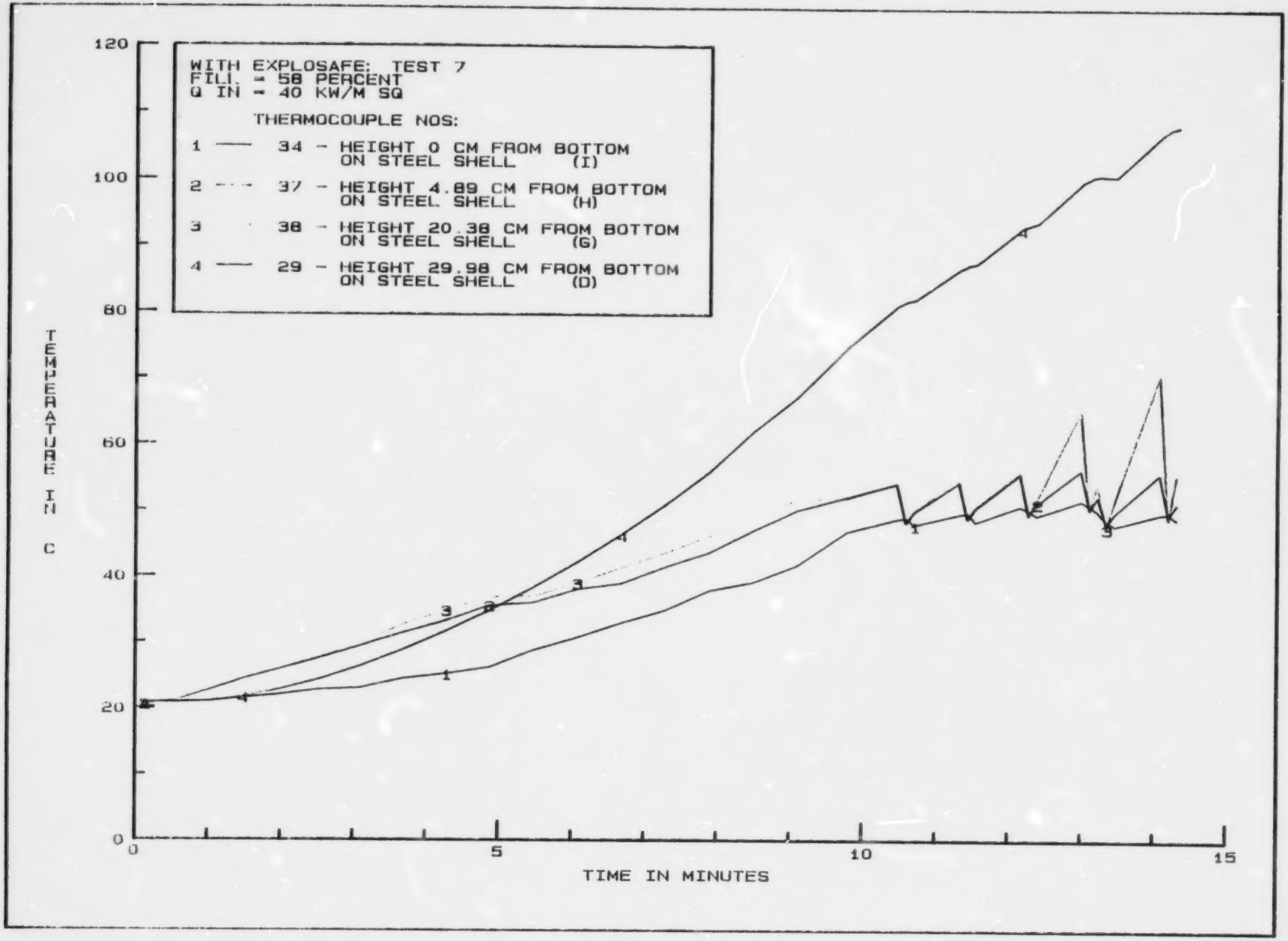
INSIDE THE MILD STEEL SHELL

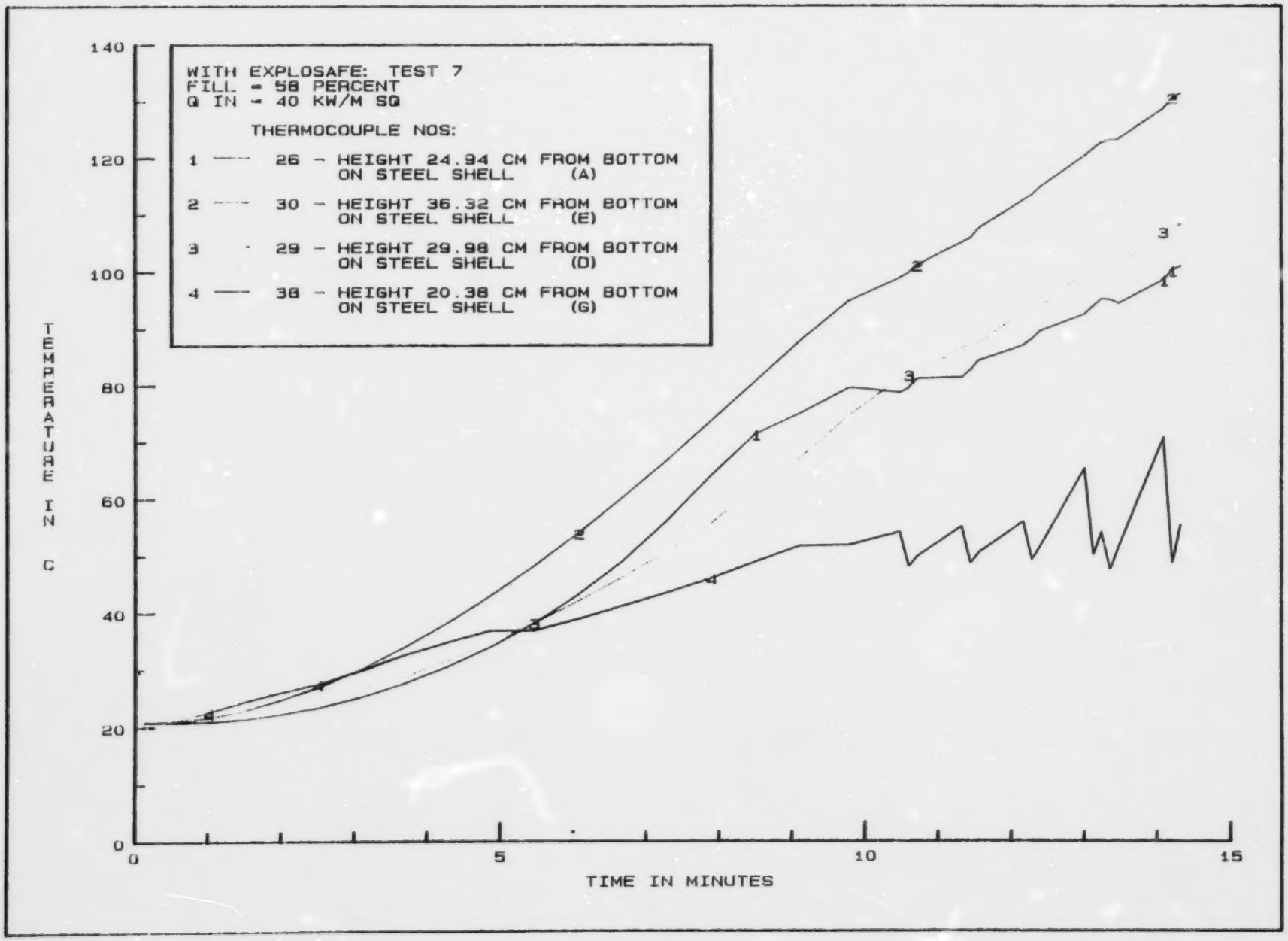
THERMOCOUPLE NUM.	HEIGHT FROM BOTTOM IN CM
ON EXPLOSAFE:	
2	2.54
3	6.78
8	17.9
1	31.32
INSIDE EXPLOSAFE:	
35 OR F	31.32
11	36.5
ON THE MILD STEEL SHELL:	
34 OR I	0
37 OR H	4.89
38 OR G	20.38
29 OR D	29.98
25 OR A	24.94
30 OR E	36.32
INSIDE THE MILD STEEL SHELL:	
27 OR B	29.98
28 OR C	36.32

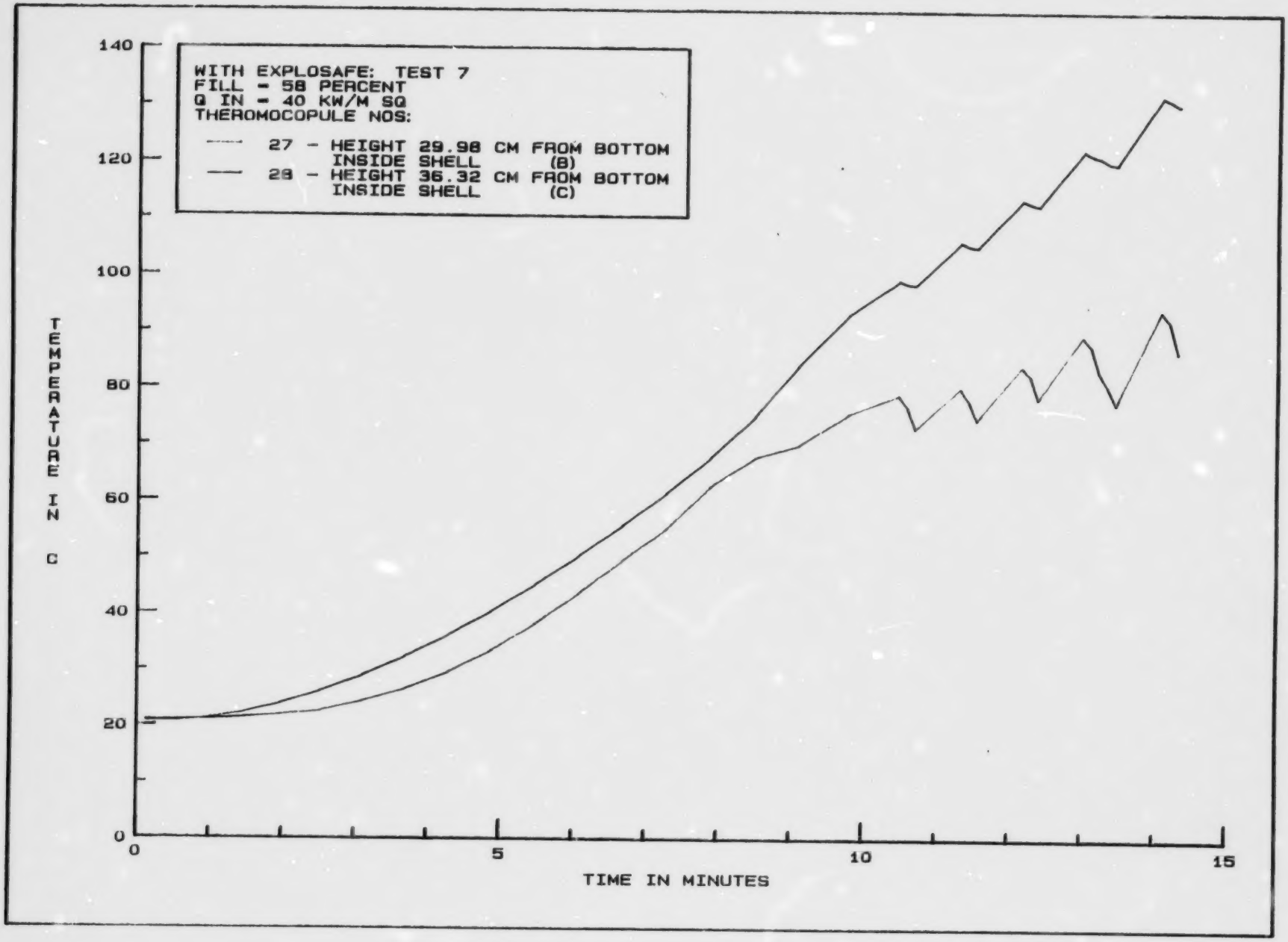
PLOTS ARE GIVEN _ PER PAGE


WITH EXPLOSAFE: TEST 7
FILL = 58 PERCENT
Q IN = 40 KW/M SQ
THERMOCOUPLE NOS:
1 - - - 2 - HEIGHT 2.54 CM FROM BOTTOM ON EXPLOSAFE
2 ---- 3 - HEIGHT 6.78 CM FROM BOTTOM ON EXPLOSAFE
3 - · 6 - HEIGHT 17.9 CM FROM BOTTOM ON EXPLOSAFE
4 —— 1 - HEIGHT 31.32 CM FROM BOTTOM ON EXPLOSAFE
TEMPERATURE IN C
70
60
50
40
30
20
0
5
10
15
TIME IN MINUTES


WITH EXPLOSAFE: TEST 7
FILL - 58 PERCENT
Q IN - 40 KW/M SQ
THEROMOCOPULE NOS:
35 - HEIGHT 31.32 CM FROM BOTTOM IN EXPLOSAFE (F)
11 - HEIGHT 36.5 CM FROM BOTTOM IN EXPLOSAFE
100
80
60
40
20
0
TEMPERATURE IN C
0
5
10
15
TIME IN MINUTES


WITH EXPLOSAFE: TEST 7
FILL = 58 PERCENT
Q IN = 40 KW/M SQ
THERMOCOUPLE NOS:
1 —— 34 - HEIGHT 0 CM FROM BOTTOM ON STEEL SHELL (I)
2 - - - 37 - HEIGHT 4.89 CM FROM BOTTOM ON STEEL SHELL (H)
3 · · 38 - HEIGHT 20.38 CM FROM BOTTOM ON STEEL SHELL (G)
4 —— 29 - HEIGHT 29.98 CM FROM BOTTOM ON STEEL SHELL (D)
TEMPERATURE IN C
120
100
80
60
40
20
0
0
5
10
15
TIME IN MINUTES


WITH EXPLOSAFE: TEST 7
FILL = 58 PERCENT
Q IN = 40 KW/M SQ
THERMOCOUPLE NOS:
1 —— 26 - HEIGHT 24.94 CM FROM BOTTOM ON STEEL SHELL (A)
2 —— 30 - HEIGHT 36.32 CM FROM BOTTOM ON STEEL SHELL (E)
3 · 29 - HEIGHT 29.98 CM FROM BOTTOM ON STEEL SHELL (D)
4 —— 38 - HEIGHT 20.38 CM FROM BOTTOM ON STEEL SHELL (G)
TEMPERATURE IN C
140
120
100
80
60
40
20
0
0
5
10
15
TIME IN MINUTES

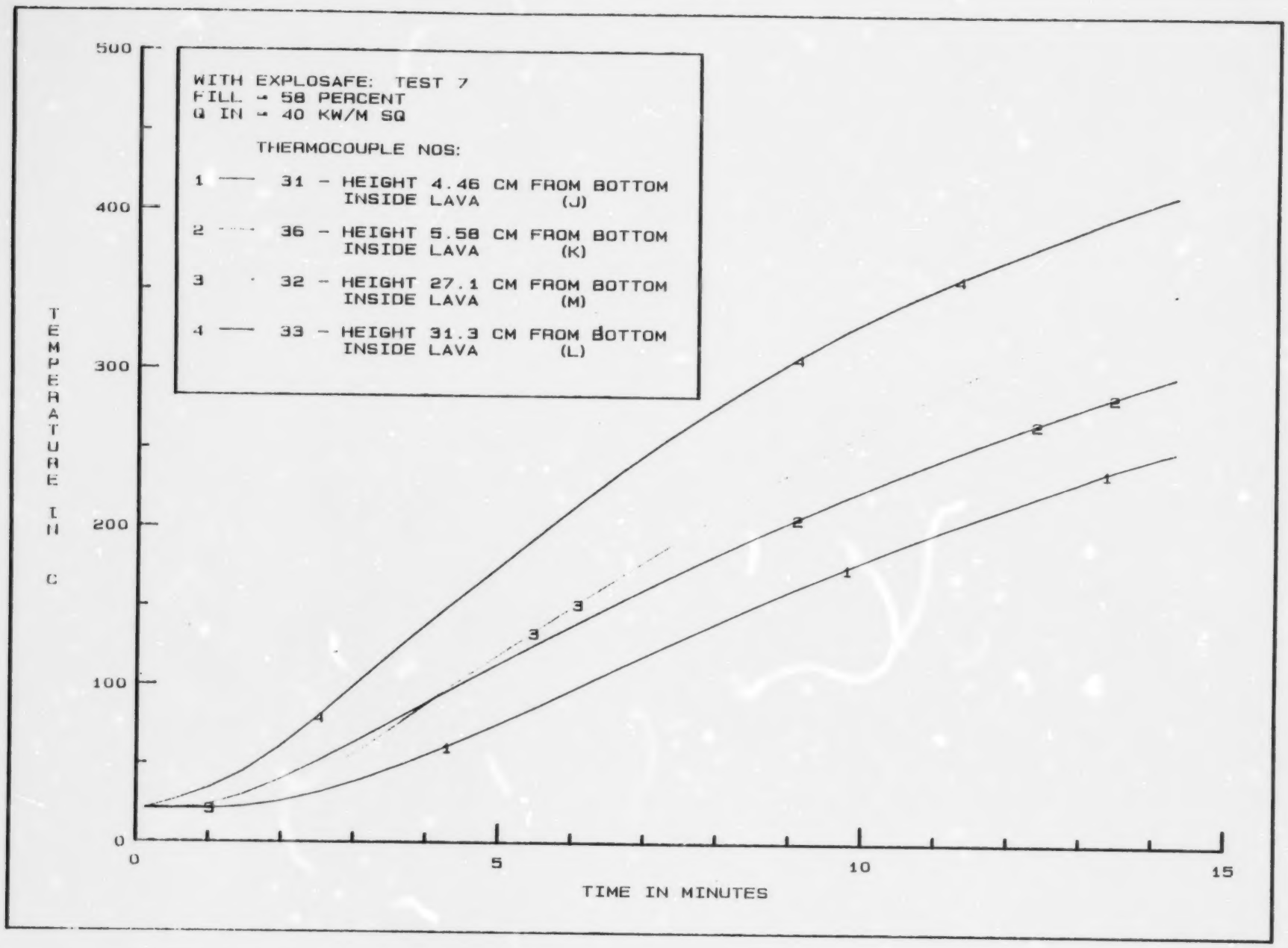

WITH EXPLOSAFE: TEST 7
FILL - 58 PERCENT
Q IN - 40 KW/M SQ
THEROMOCOPULE NOS:
27 - HEIGHT 29.98 CM FROM BOTTOM INSIDE SHELL (B)
28 - HEIGHT 36.32 CM FROM BOTTOM INSIDE SHELL (C)
TEMPERATURE IN C
140
120
100
80
60
40
20
0
0
5
10
15
TIME IN MINUTES

FOLLOWING THERMOCOUPLES ARE PLACED

IN THE LAVA MEDIUM

THERMOCOUPLE NUM.	HEIGHT FROM BOTTOM IN CM
38 OR K	5.58
31 OR J	4.46
32 OR M	27.1
33 OR L	31.3

ALL FOUR PLOTS ARE GIVEN IN ONE PAGE


WITH EXPLOSAFE: TEST 7
FILL = 58 PERCENT
Q IN = 40 KW/M SQ
THERMOCOUPLE NOS:
1 —— 31 - HEIGHT 4.46 CM FROM BOTTOM INSIDE LAVA (J)
2 - - - 36 - HEIGHT 5.58 CM FROM BOTTOM INSIDE LAVA (K)
3 · · 32 - HEIGHT 27.1 CM FROM BOTTOM INSIDE LAVA (M)
4 —— 33 - HEIGHT 31.3 CM FROM BOTTOM INSIDE LAVA (L)
TEMPERATURE IN C
500
400
300
200
100
0
0
5
10
15
TIME IN MINUTES

TEST 7

WITH EXPLOSAFE

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITH EXPLOSAFE - FILE NAME : TEST 7 (UNBT27)

DATA OF TEST :AUG/DEC 1983 Q IN = 40 KW/M SQ LIQUID LEVEL = 58 PERCENT

SET PRESSURE = 25 PSIG PRV ORIFICE DIAMETER = 3/8 INCHES

	TIME MINS	PRESSURE PSIG	THRM#1 C	THRM#2 C	THRM#3 C	THRM#4 C	THRM#5 C	THRM#6 C	THRM#7 C	THRM#8 C	THRM#9 C	THRM#10 C	THRM#11 C
1.	0.129	-1.290	20.646	20.671	20.597	20.597	20.993	20.597	20.597	20.597	21.093	20.919	20.547
2.	0.563	-1.251	20.682	20.657	20.583	20.608	21.029	20.608	20.608	20.583	21.228	20.955	20.558
3.	1.008	-1.156	20.746	20.721	20.597	20.597	21.093	20.622	20.622	20.572	21.341	21.043	20.647
4.	1.474	-0.838	21.082	20.834	20.785	20.785	21.305	20.859	20.810	20.760	21.553	21.231	20.834
5.	1.967	-0.318	21.716	21.617	21.047	21.220	22.087	21.369	21.344	20.948	22.309	21.839	21.195
6.	2.507	0.413	22.473	21.929	21.780	21.780	23.312	22.374	22.547	21.805	23.658	22.720	21.681
7.	3.096	1.525	23.772	22.711	22.612	22.761	25.421	25.200	23.674	22.736	25.888	24.166	22.489
8.	3.685	2.982	25.239	23.984	23.861	23.960	27.740	27.275	26.614	23.910	28.326	25.853	23.393
9.	4.278	4.512	26.775	24.934	25.352	25.352	30.070	28.852	28.193	25.155	30.581	27.680	24.319
10.	4.872	6.354	28.575	25.908	26.692	26.864	32.392	31.083	30.062	26.374	32.900	29.819	25.490
11.	5.469	8.180	30.733	28.053	29.029	29.273	34.846	34.002	32.358	28.273	35.400	32.237	26.707
12.	6.075	10.207	33.462	29.361	31.913	32.131	37.072	35.559	35.078	30.894	37.743	34.572	28.068
13.	6.677	12.547	36.536	31.298	34.370	34.491	39.289	37.783	36.824	32.921	40.267	37.351	29.986
14.	7.283	15.249	40.233	34.071	36.742	36.670	41.756	40.376	39.088	35.156	42.847	40.591	31.968
15.	7.893	18.321	44.587	36.611	38.958	39.005	44.256	42.836	41.768	37.953	45.554	45.954	34.301
16.	8.500	21.894	49.628	38.828	41.212	41.592	47.285	45.284	44.175	40.212	48.552	50.025	38.206
17.	9.101	25.574	56.629	41.273	44.023	44.212	50.272	48.541	46.946	42.175	51.578	51.857	44.188
18.	9.705	25.585	60.253	45.550	46.374	45.833	50.592	48.886	47.009	46.115	51.128	54.219	49.564
19.	10.477	28.343	62.370	47.963	48.198	48.315	52.880	51.400	49.883	48.948	53.422	54.789	52.702
20.	10.598	19.169	62.666	48.267	48.993	48.853	48.502	49.508	48.666	48.947	48.267	54.279	53.236
21.	10.708	22.252	61.139	46.721	46.650	46.650	47.426	47.050	46.627	46.979	48.083	51.448	50.515
22.	11.322	30.482	63.915	48.451	48.990	49.668	53.627	52.582	51.139	49.294	54.206	55.779	53.603
23.	11.444	19.929	64.570	49.220	49.711	49.945	52.183	50.085	49.594	49.945	50.879	55.359	54.897
24.	11.553	23.000	62.889	47.371	47.301	47.324	48.075	47.747	47.324	47.747	48.755	52.348	51.767
25.	12.164	30.767	66.764	49.146	49.870	49.450	54.592	54.291	52.202	49.824	55.170	58.374	58.143
26.	12.285	20.811	67.622	50.010	50.617	51.991	50.150	50.943	50.547	50.500	54.220	57.776	63.815
27.	12.395	24.318	65.633	48.163	47.999	48.046	48.842	48.491	48.069	48.467	49.521	54.106	54.014
28.	13.005	32.565	71.018	50.842	51.009	51.638	55.627	55.234	53.544	50.916	56.204	62.125	73.256
29.	13.127	21.950	72.363	50.916	51.358	52.940	54.471	51.871	51.754	51.335	55.188	60.983	66.827
30.	13.236	25.596	69.064	48.955	48.861	48.838	49.680	49.376	48.885	49.236	50.428	56.206	55.837
31.	13.357	19.024	68.459	49.193	49.099	49.169	48.514	49.380	48.889	49.333	50.175	55.171	58.605
32.	13.467	22.313	64.681	46.591	46.497	46.450	47.460	47.155	46.497	46.896	47.930	52.111	52.460
33.	14.088	31.169	72.857	48.861	50.123	50.520	54.541	55.074	53.290	49.633	55.143	64.494	76.069
34.	14.209	20.548	74.799	49.585	50.426	52.104	53.869	50.613	50.473	50.566	54.332	62.855	69.602
35.	14.319	24.239	71.223	47.784	47.667	47.691	51.688	49.050	47.784	48.136	51.292	56.669	55.931

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITH EXPLOSAFE - FILE NAME : TEST 7 (UNBT27)

DATA OF TEST :AUG/DEC 1983 Q IN = 40 KW/M SQ LIQUID LEVEL = 50 PERCENT

SET PRESSURE = 25 PSIG PRV ORIFICE DIAMETER = 3/8 INCHES

	TIME MINS	PRESSURE PSIG	THRM#12 C	THRM#13 C	THRM#14 C	THRM#15 C	THRM#16 C	THRM#17 C	THRM#18 C	THRM#19 C	THRM#20 C	THRM#21 C	THRM#22 C
1.	0.129	-1.290	20.894	20.795	20.845	20.845	20.869	20.969	20.597	20.845	2.418	20.249	20.597
2.	0.563	-1.251	20.955	20.856	20.856	20.881	20.881	20.980	20.608	20.881	2.419	20.285	20.657
3.	1.008	-1.156	20.994	20.895	20.944	20.919	20.944	21.068	20.795	20.944	2.421	20.249	20.746
4.	1.474	-0.838	21.280	21.107	21.132	21.181	21.181	21.256	21.998	21.454	2.422	20.437	20.958
5.	1.967	-0.318	22.260	21.641	21.691	21.839	21.815	21.988	23.519	22.655	2.423	20.799	21.740
6.	2.507	0.413	23.682	22.399	22.473	22.646	22.646	22.967	25.110	24.224	2.425	21.557	22.819
7.	3.096	1.625	25.961	23.698	23.822	24.093	24.019	24.683	27.260	26.599	2.427	22.415	24.757
8.	3.685	2.982	28.375	25.166	25.313	25.706	25.534	26.712	29.009	28.887	2.428	23.763	26.981
9.	4.278	4.512	30.630	26.652	26.922	27.484	27.240	28.901	31.043	31.018	2.429	26.309	29.316
10.	4.872	6.354	32.852	28.356	28.746	29.502	29.161	31.398	32.803	33.311	2.431	27.476	31.835
11.	5.469	8.180	35.159	30.417	30.806	31.801	31.243	34.002	34.726	35.376	2.432	30.514	34.243
12.	6.075	10.207	37.192	32.664	32.760	34.089	33.341	36.400	36.832	37.480	2.434	33.196	36.736
13.	6.677	12.547	39.432	36.608	35.302	36.800	35.887	38.787	39.098	39.766	2.436	35.791	39.241
14.	7.283	15.249	41.851	40.186	38.873	40.448	39.184	41.494	41.590	42.231	2.437	38.036	42.254
15.	7.893	18.321	44.469	43.688	42.986	44.114	43.097	44.469	44.067	44.894	2.438	40.127	44.823
16.	8.500	21.894	47.285	48.270	47.543	49.581	49.043	47.919	46.791	47.801	2.440	42.565	48.341
17.	9.101	25.574	49.922	52.996	51.811	51.834	52.787	50.902	49.337	50.506	2.441	45.274	51.601
18.	9.705	25.585	50.755	57.774	56.438	55.537	56.945	50.872	49.658	50.942	2.443	46.186	50.825
19.	10.477	28.343	52.981	61.137	59.351	58.529	58.249	53.028	52.051	53.097	2.444	48.667	52.935
20.	10.598	19.169	48.127	56.659	56.360	54.186	55.736	51.631	48.267	48.150	2.444	48.150	47.141
21.	10.708	22.252	47.778	50.982	51.681	51.122	52.053	49.324	46.674	48.153	2.445	46.344	48.247
22.	11.322	30.482	53.719	62.412	60.721	56.402	59.553	53.812	53.232	53.812	2.446	50.136	53.719
23.	11.444	19.929	48.5[illegible]	57.781	57.528	55.244	56.975	51.764	48.916	48.916	2.446	49.056	50.295
24.	11.553	23.000	48.46[illegible]	51.790	52.465	52.302	52.906	50.158	48.802	48.825	2.446	47.183	48.942
25.	12.164	30.767	54.661	65.133	63.656	59.637	63.224	54.800	54.754	54.777	2.448	49.824	54.707
26.	12.285	20.811	49.332	59.888	60.026	58.121	59.957	53.873	49.776	49.589	2.448	49.612	52.735
27.	12.395	24.318	48.217	53.155	54.153	54.245	54.824	51.481	49.591	49.614	2.448	47.905	51.248
28.	13.005	32.565	55.696	70.501	68.160	62.147	66.510	56.435	55.812	55.812	2.450	52.150	55.858
29.	13.127	21.950	50.402	63.310	63.219	60.662	62.581	55.604	50.776	50.426	2.450	50.692	55.049
30.	13.236	25.596	50.101	55.028	56.114	56.206	56.714	53.685	50.474	50.498	2.450	48.814	53.383
31.	13.357	19.024	48.045	54.662	55.379	55.124	55.610	52.760	48.350	47.857	2.451	48.115	52.342
32.	13.467	22.313	47.625	50.690	51.492	52.111	52.111	51.156	47.977	48.023	2.451	46.379	49.896
33.	14.088	31.169	54.634	74.666	71.558	66.376	69.198	57.450	54.750	54.727	2.453	51.593	55.975
34.	14.209	20.548	49.328	65.967	65.265	63.014	64.038	56.528	49.398	48.953	2.453	49.421	54.865
35.	14.319	24.239	49.050	55.284	56.300	56.738	56.784	54.034	49.401	49.424	2.453	47.620	53.176

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITH EXPLOSAFE - FILE NAME : TEST 7 (UNBT27)

DATA OF TEST :AUG/DEC 1983 Q IN = 40 KW/M SQ LIQUID LEVEL = 50 PERCENT

SET PRESSURE = 25 PSIG PRV ORIFICE DIAMETER = 3/8 INCHES

	TIME MINS	PRESSURE PSIG	THRM#23 C	THRM#24 C	THRM#25 C	THRM#26 C	THRM#27 C	THRM#28 C	THRM#29 C	THRM#30 C	THRM#31 C	THRM#32 C	THRM#33 C
1.	0.129	-1.290	20.572	20.274	21.043	20.664	20.722	20.586	20.703	20.742	20.800	20.897	20.858
2.	0.563	-1.251	20.632	20.286	21.203	20.684	20.762	20.743	20.743	20.956	20.820	20.937	27.069
3.	1.008	-1.156	20.671	20.299	21.415	20.845	20.845	21.233	21.019	21.640	21.039	21.698	34.399
4.	1.474	-0.838	20.909	20.487	21.751	21.333	21.197	22.244	21.682	22.844	22.399	25.031	44.915
5.	1.967	-0.310	21.592	20.824	22.507	22.153	21.707	23.818	22.734	24.592	25.693	32.317	60.318
6.	2.507	0.413	22.497	21.632	23.756	23.359	22.371	25.969	24.249	26.934	31.420	43.785	79.918
7.	3.096	1.625	23.994	22.933	26.108	25.221	24.099	28.809	26.341	30.079	39.714	58.674	103.100
8.	3.685	2.982	25.657	23.935	28.399	27.598	26.305	32.157	28.812	33.903	49.713	77.304	126.110
9.	4.278	4.512	27.607	25.965	30.605	30.531	29.281	35.960	31.646	38.178	60.808	97.170	148.460
10.	4.872	6.354	29.940	27.720	32.997	33.992	33.129	40.187	34.759	42.949	72.585	115.160	169.980
11.	5.469	8.180	32.310	31.195	35.063	38.226	37.806	44.875	38.264	48.252	85.024	133.450	192.210
12.	6.075	10.207	35.029	33.365	37.168	43.264	43.321	50.057	42.122	54.064	98.548	151.790	214.590
13.	6.677	12.547	37.663	35.502	39.432	49.100	49.156	55.486	46.313	60.230	111.870	169.510	235.800
14.	7.283	15.249	41.518	37.797	41.898	56.190	54.832	61.287	50.847	66.762	124.810	187.090	255.630
15.	7.893	18.321	46.731	40.174	44.516	64.163	62.419	67.683	55.855	73.714	137.650	204.690	274.020
16.	8.500	21.894	49.932	42.584	47.473	71.428	67.523	74.933	61.976	80.679	150.260	221.680	291.410
17.	9.101	25.574	51.135	45.557	50.295	75.012	69.752	84.060	67.172	87.671	162.280	237.820	308.100
18.	9.705	25.585	52.129	45.456	50.848	79.580	75.339	93.114	74.725	94.849	175.190	255.550	325.650
19.	10.477	28.343	53.445	48.292	53.004	78.583	78.769	99.203	81.091	98.817	188.210	272.640	341.360
20.	10.598	19.169	52.376	47.939	47.751	79.563	76.551	98.499	81.754	99.750	190.330	275.490	343.830
21.	10.708	22.252	50.865	46.321	48.223	81.145	72.698	98.428	81.980	101.080	192.250	278.110	346.190
22.	11.322	30.482	54.183	49.551	53.766	81.360	80.098	105.050	86.606	105.020	202.750	292.360	358.560
23.	11.444	19.929	53.228	48.729	48.307	82.693	77.549	105.260	87.233	105.810	204.720	295.040	360.850
24.	11.553	23.000	51.441	47.371	48.942	84.327	74.293	105.080	87.475	107.440	206.580	297.450	362.930
25.	12.164	30.767	56.440	50.478	54.731	87.025	83.932	113.560	92.773	112.460	216.680	310.340	374.260
26.	12.285	20.811	55.007	49.496	48.957	88.095	82.167	112.840	93.342	113.430	218.750	312.650	376.300
27.	12.395	24.318	53.063	48.022	49.825	89.465	78.101	112.480	93.713	114.780	220.660	314.750	378.500
28.	13.005	32.565	59.171	52.150	55.766	92.434	89.312	122.310	99.788	120.210	230.480	326.220	389.560
29.	13.127	21.950	57.472	50.356	49.631	93.889	87.367	121.410	100.480	121.590	232.660	328.440	391.700
30.	13.236	25.596	54.866	48.838	50.661	95.089	82.847	121.010	100.780	122.650	234.510	330.470	393.750
31.	13.357	19.024	53.201	47.904	47.223	94.649	80.230	120.080	100.580	123.030	236.400	332.710	395.980
32.	13.467	22.313	51.669	46.426	48.234	94.229	77.190	119.900	100.530	123.210	238.030	334.680	397.830
33.	14.088	31.169	61.510	52.709	54.750	98.493	93.867	131.920	106.870	128.650	246.580	345.640	408.140
34.	14.209	20.548	58.484	49.187	48.860	100.170	91.797	131.100	107.770	130.560	248.010	347.740	409.930
35.	14.319	24.239	55.363	47.761	49.752	100.870	86.438	130.290	108.120	131.360	249.480	349.640	411.600

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITH EXPLOSAFE - FILE NAME : TEST 7 (UNBT27)

DATA OF TEST :AUG/DEC 1983 Q IN = 40 KW/M SQ LIQUID LEVEL = 58 PERCENT

SET PRESSURE = 25 PSIG PRV ORIFICE DIAMETER = 3/8 INCHES

	TIME MINS	PRESSURE PSIG	THRM#34 C	THRM#35 C	THRM#36 C	THRM#37 C	THRM#38 C	THRM#39 C	THRM#40 C
1.	0.129	-1.290	20.625	20.722	20.836	20.606	20.683	*******	2.458
2.	0.563	-1.251	20.840	20.743	21.383	21.111	21.170	*******	2.458
3.	1.008	-1.156	20.942	20.864	24.022	22.667	22.648	*******	2.458
4.	1.474	-0.838	21.507	21.236	30.217	24.373	24.393	*******	2.459
5.	1.967	-0.318	21.959	21.959	39.552	25.848	25.964	*******	2.459
6.	2.507	0.413	22.759	22.759	51.654	27.493	27.570	*******	2.460
7.	3.096	1.625	23.035	24.157	65.937	29.425	29.087	*******	2.460
8.	3.685	2.982	24.470	25.610	80.687	31.447	32.618	*******	2.460
9.	4.278	4.512	25.231	27.354	95.567	33.278	34.849	*******	2.461
10.	4.872	6.354	26.201	29.305	110.270	35.601	36.883	*******	2.462
11.	5.469	8.180	28.771	32.155	124.890	36.027	36.945	-49.000	2.462
12.	6.075	10.207	30.720	35.823	139.430	38.098	39.015	-49.000	2.463
13.	6.677	12.547	32.937	39.900	153.650	38.965	41.330	*******	2.464
14.	7.283	15.249	34.879	44.457	167.600	41.508	43.602	-55.000	2.464
15.	7.893	18.321	37.888	49.603	181.110	43.721	46.171	*******	2.465
16.	8.500	21.894	39.175	55.279	194.100	47.090	49.080	*******	2.465
17.	9.101	25.574	41.735	63.819	206.450	50.164	51.829	*******	2.466
18.	9.705	25.585	46.840	69.763	220.090	52.142	52.010	*******	2.467
19.	10.477	20.343	48.781	71.170	233.350	54.188	54.282	-91.000	2.468
20.	10.598	19.169	49.005	71.482	235.610	48.283	48.132	-74.000	2.467
21.	10.708	22.252	47.869	71.802	237.580	49.934	49.953	*******	2.468
22.	11.322	30.482	49.548	73.399	248.740	54.424	55.292	-45.000	2.469
23.	11.444	19.929	49.791	73.881	250.880	48.920	48.712	*******	2.469
24.	11.553	23.000	48.316	74.218	252.790	50.531	50.607	*******	2.469
25.	12.164	30.767	50.790	77.061	263.270	55.756	56.095	*******	2.470
26.	12.285	20.811	50.030	77.783	265.290	49.671	49.311	*******	2.470
27.	12.395	24.316	49.313	77.953	267.090	51.300	51.678	*******	2.470
28.	13.005	32.565	51.634	81.940	276.990	56.352	65.350	*******	2.471
29.	13.127	21.950	50.795	83.032	278.900	50.496	50.118	*******	2.471
30.	13.236	25.596	49.948	82.996	280.550	52.256	54.200	*******	2.471
31.	13.357	19.024	48.490	82.569	282.520	48.149	47.642	-0.000	2.471
32.	13.467	22.313	47.740	81.575	284.230	49.767	51.451	-0.001	2.472
33.	14.088	31.169	49.603	85.753	293.690	55.762	70.767	-0.001	2.472
34.	14.209	20.548	49.733	87.101	295.480	49.316	48.691	-0.001	2.472
35.	14.319	24.239	48.751	86.993	297.090	51.155	55.328	-0.001	2.472

PLOTS OF A TEST

CARRIED OUT ON THE UNB TANK 2

WITHOUT EXPLOSAFE

TEST NUMBER 13

Q in = 65 kW/m sq

LIQUID LEVEL = 76 %

SET PRESSURE = 35 psig

PRV ORIFICE DIAMETER = 1/4 in.

Date of Test JAN 13, 1984

TABLE OF CONTENTS

Thermocouple Grid Layout - - - - - - - - - - - - -

1. For the Thermocouples Placed in a Vertical Line:
   (a) Plots of Temperature Vs Time - - - - - - - -
   (b) Plots of Height Vs. Temperature - - - - - - -

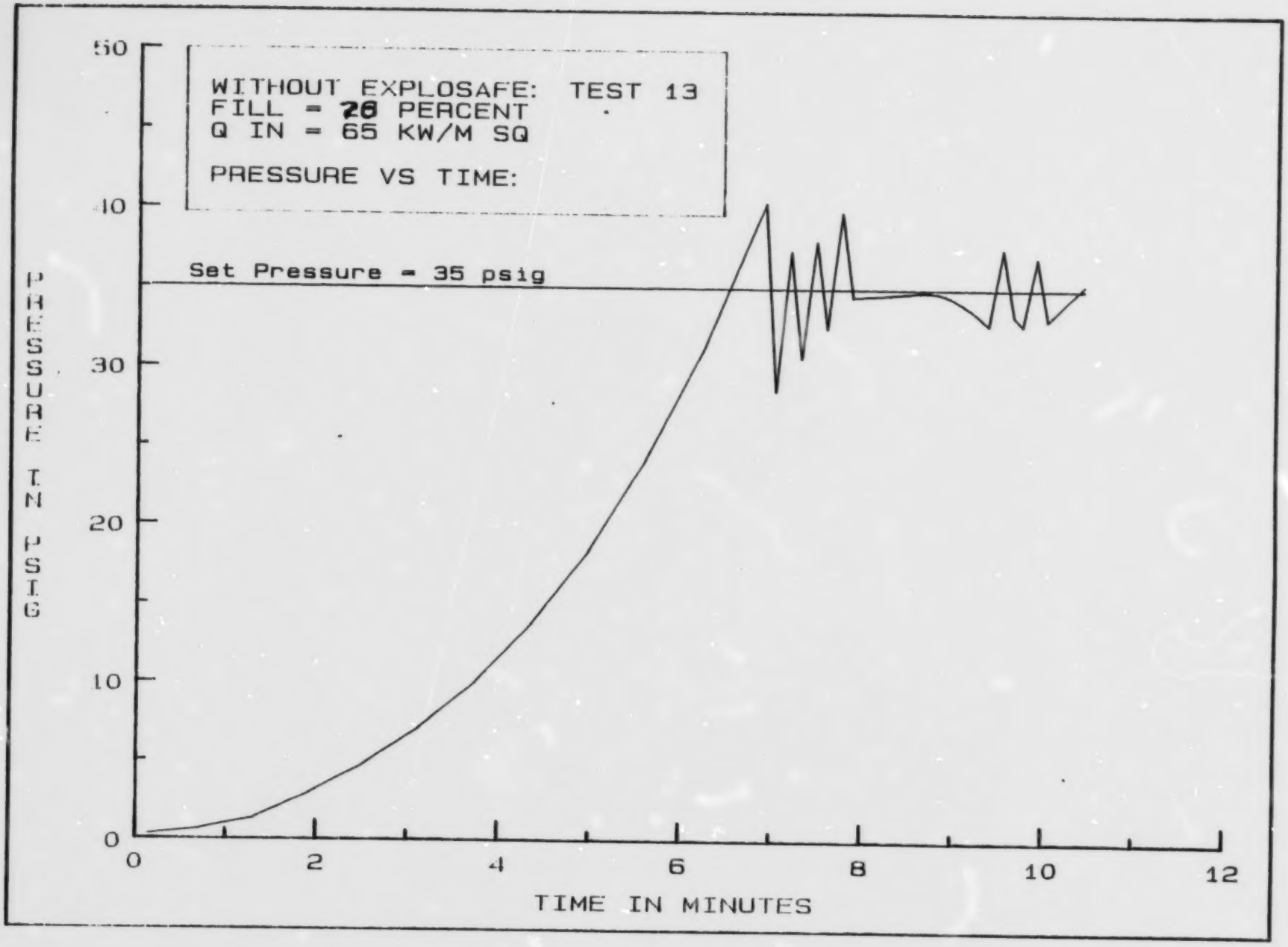
2. Thermocouples Placed in the Four Quadrants
   in a Vertical Plane: Temp. Vs. Time - - - - - -

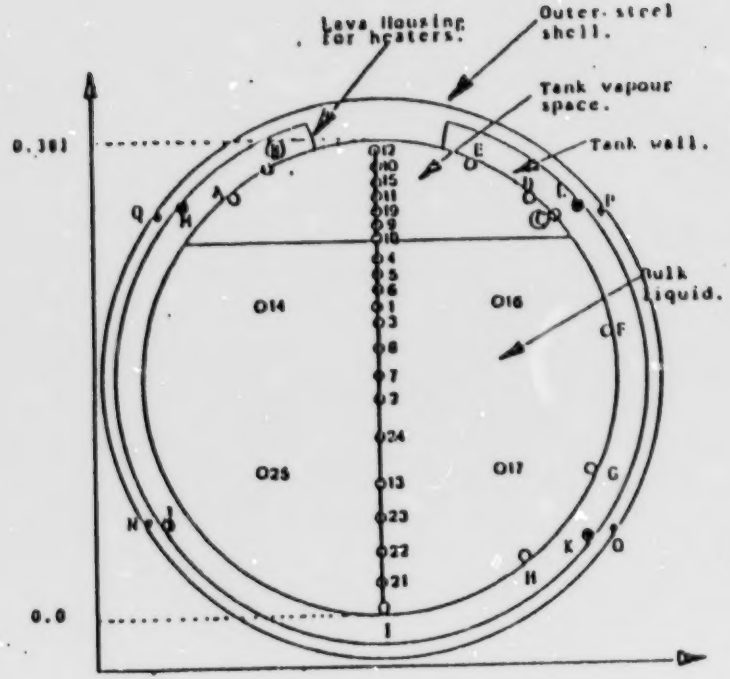
Thermocouple Grid Layout - - - - - - - - - - - -

3. Thermocouples Placed On and Inside the
   Mild Steel Shell: Temp. Vs. Time - - - - - - -

4. Thermocouples Placed in the Lava Medium
   Temp. Vs. Time - - - - - - - - - - - - - - - -

6. Print out of Data - - - - - - - - - - - - - -


WITHOUT EXPLOSAFE: TEST 13
FILL = 26 PERCENT
Q IN = 65 KW/M SQ
PRESSURE VS TIME:
Set Pressure = 35 psig
PRESSURE IN PSIG
50
40
30
20
10
0
0
2
4
6
8
10
12
TIME IN MINUTES



SYMBOL	Thermocouple #.	Angle (Deg)
A	26	310
B	34	20
C	27	56
D & E	28 & 29	48 & 25
F & G	38 & 35	78 & 110
H & I	37 & 36	142 & 180
J & K	30 & 31	133 & 220
L & M	32 & 33	50 & 300
N & O	42 & 43	140 & 230
P & Q	39 & 41	60 & 310

○ Circled thermocouples are inserted inside the vapour space wall.

Number 44 represents pressure(vessel) in psig.
Number 45 represents time in seconds.
Reference upper diameter = 45.47 cms.

Thermocouple number#.	Height (cm)	Angle with the vertical (Deg.)	Doubtful or faulty Thermocouple.
12	42.57	-	-
10	41.545	-	-
15	40.495	-	-
11	39.475	-	-
19	38.55	-	YES.
09	37.575	-	-
18	36.595	-	-
04	34.62	-	-
05	33.59	-	-
06	32.60	-	-
01	31.16	-	-
03	30.63	-	YES.
08	29.61	-	-
07	27.635	-	-
02	24.72	-	-
24	22.87	-	-
13	21.83	-	-
23	17.82	-	-
22	14.38	-	-
21	10.34	-	-
36	07.63	180	-
26	-	310	-
27 & 28	-	56 & 48	-
29 & 38	-	25 & 78	-
35 & 37	-	110 & 142	-
30 & 31	-	133 & 220	-
33 & 34	-	300 & 20	YES.
32 & 39	-	50 & 60	-
41 & 42	-	310 & 140	-
43	-	230	-
14	31.2	-	-
16	31.2	-	-
25	22.8	-	-
17	22.8	-	-
20 & 40	Reference Temperature	-	-

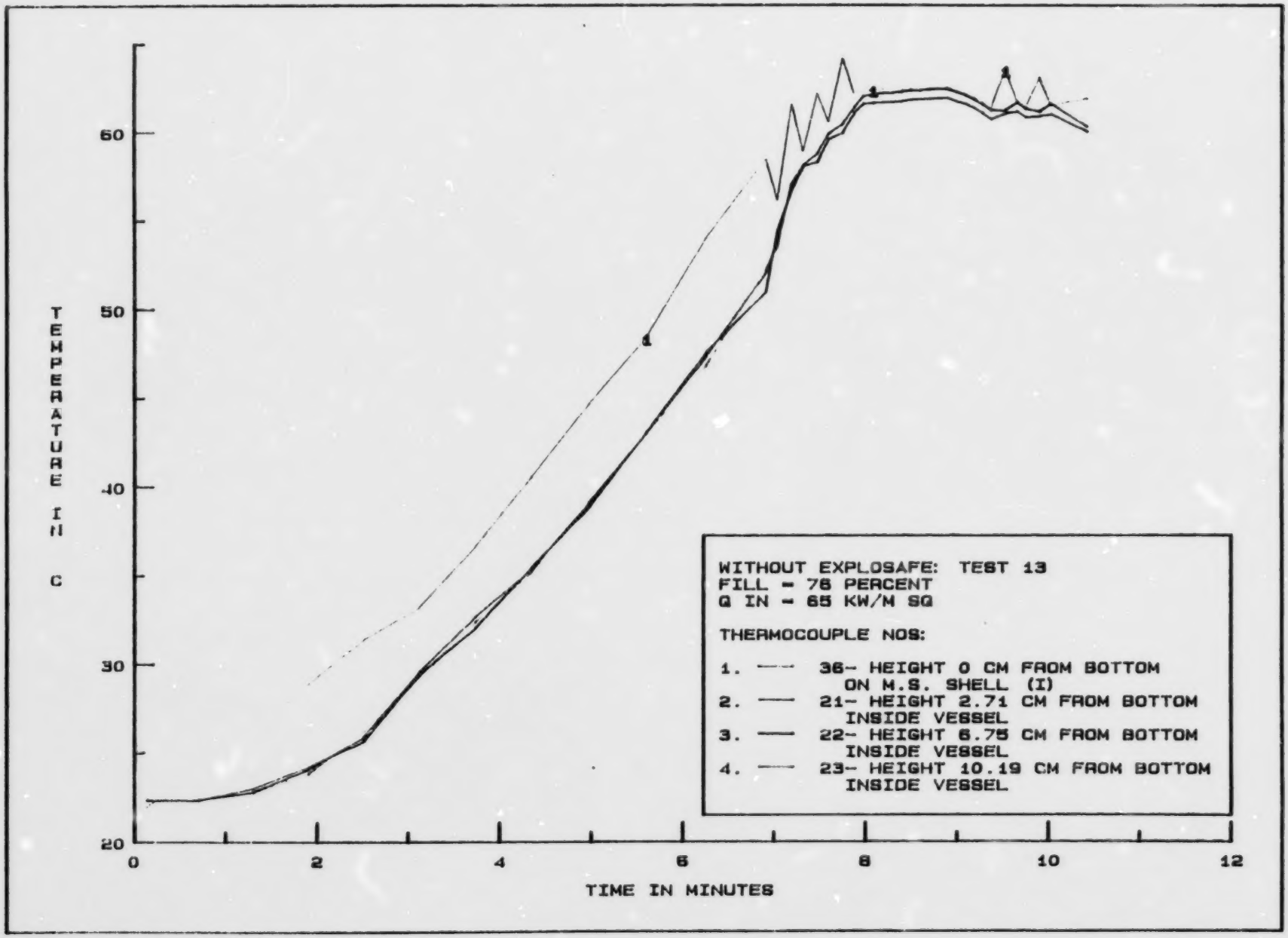
Fig. III.A A grid layout of thermocouples along with their locations for an unprotected vessel(UNB) with the PRV orifice of 1/4 in. (Valid for 76, 58 and 23 percent liquid full cases)

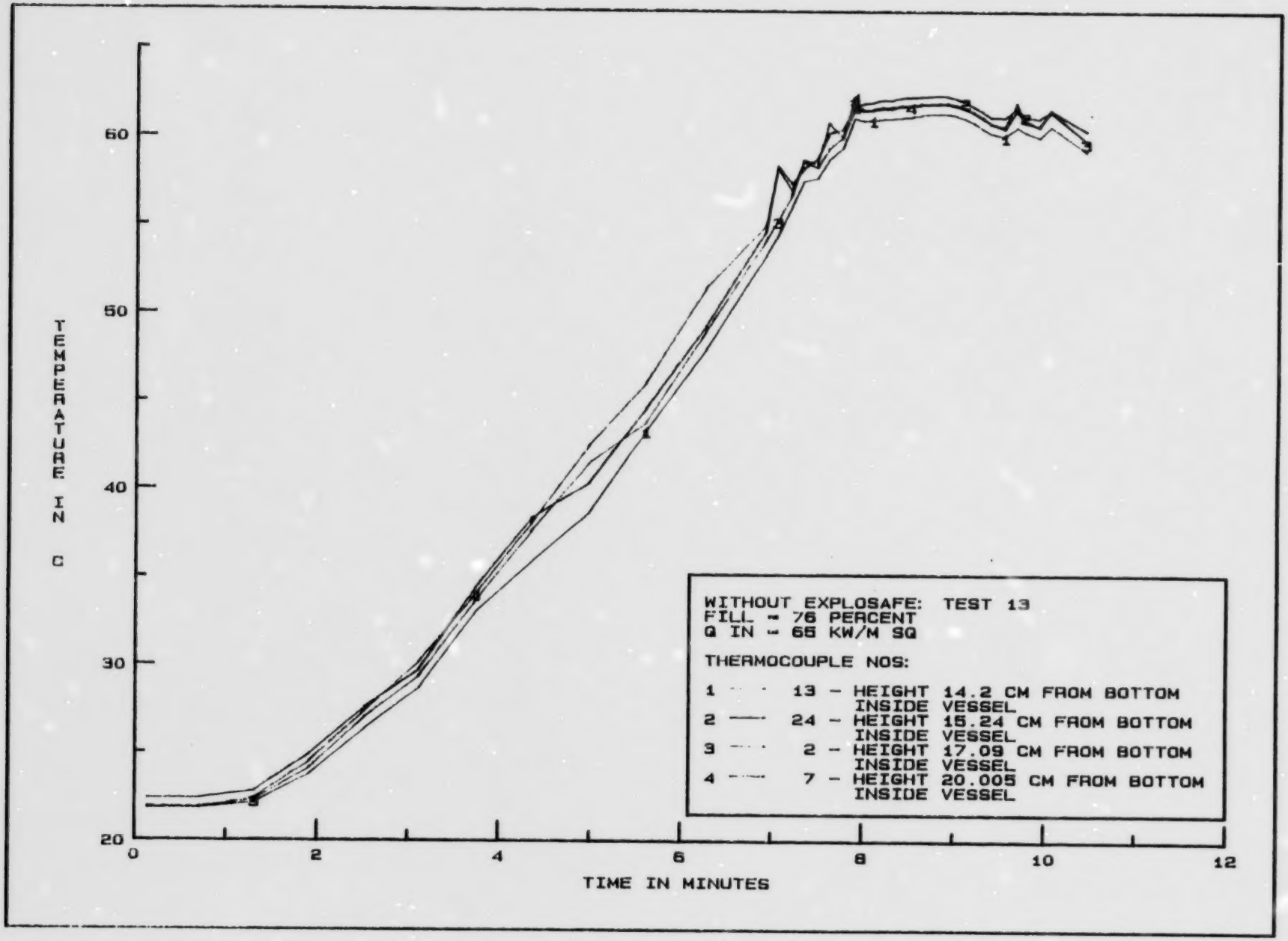
FOLLOWING THERMOCOUPLES ARE PLACED

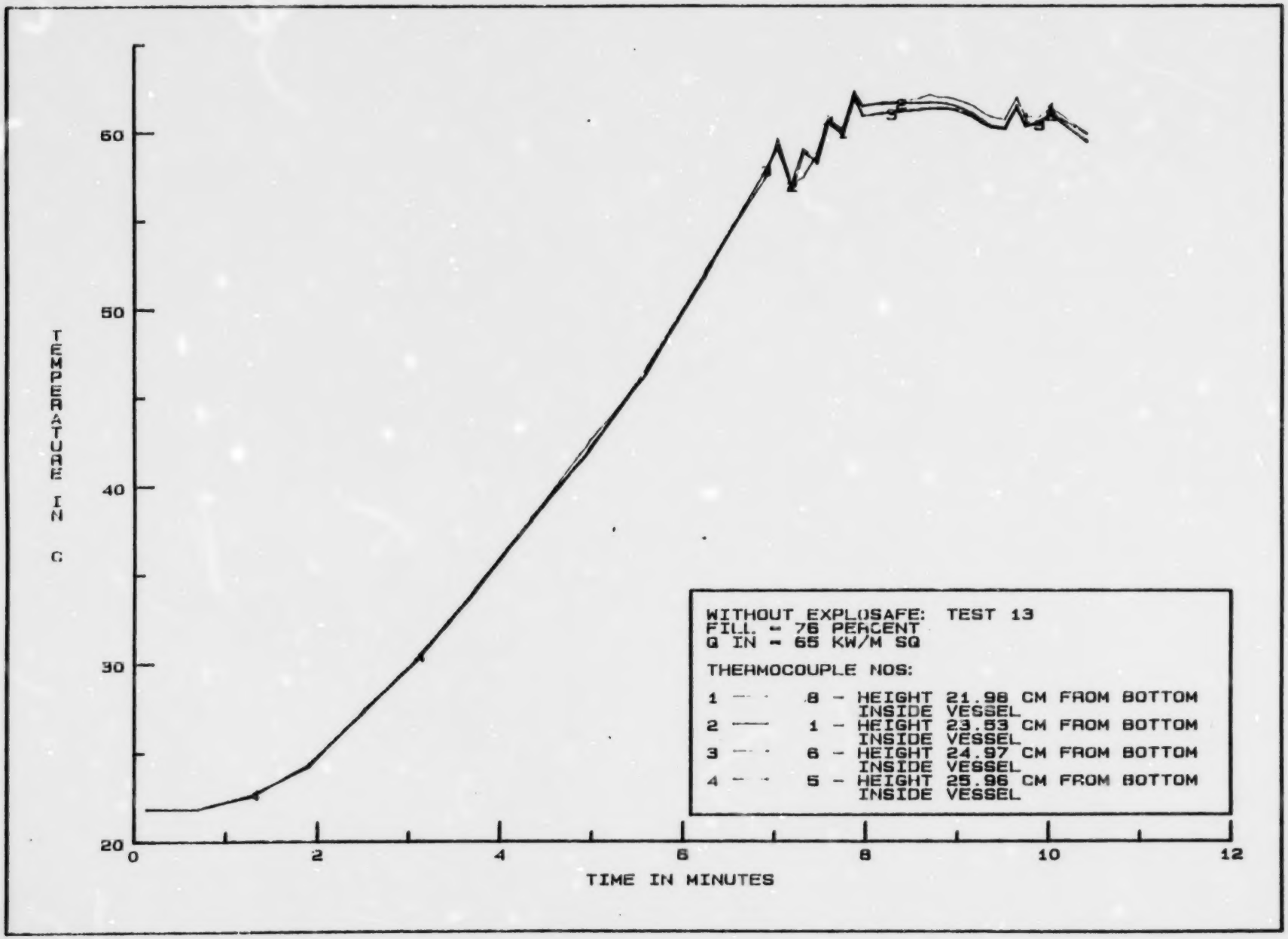
AT THE CENTRE OF THE VESSEL (DIA. 38.1 CM)

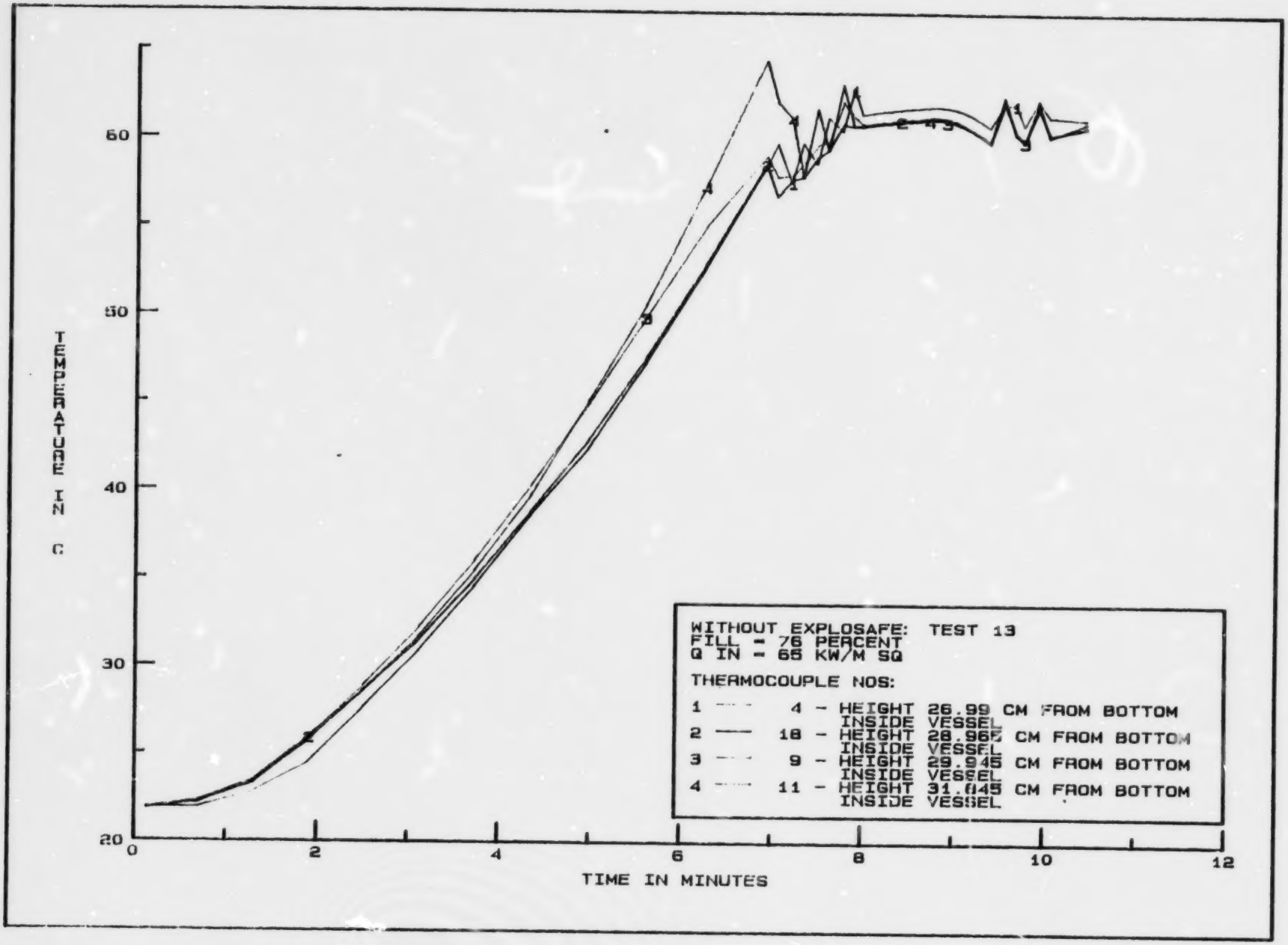
IN A VERTICLE AXIS

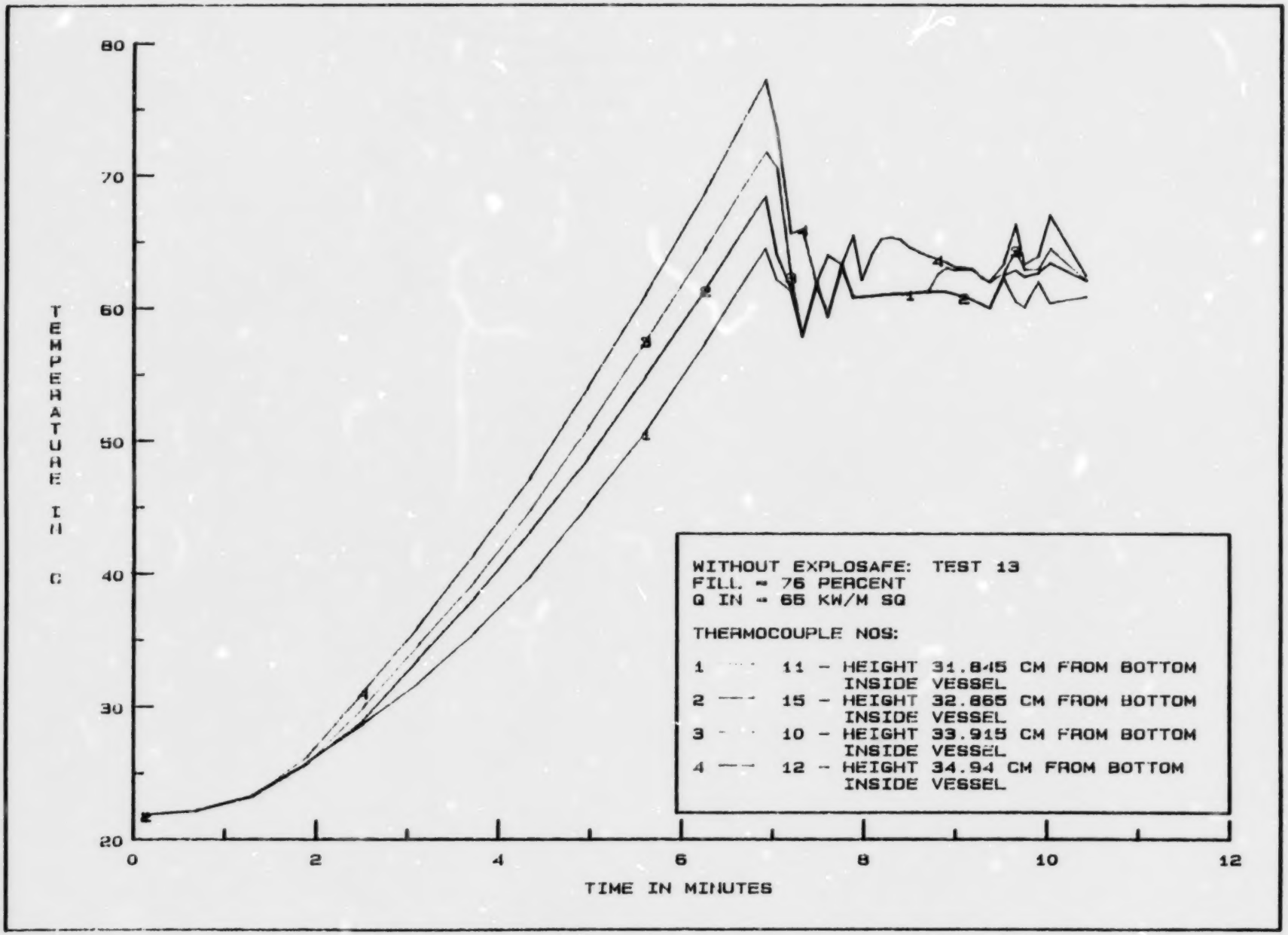
THERMOCOUPLE NUM.	HEIGHT FROM BOTTOM IN CM
38 OR I	0
21	2.71
22	6.75
23	10.19
13	14.2
24	15.24
2	17.09
7	20.005
3	21.99
1	23.53
6	24.97
5	25.96
4	26.99
19	28.965
9	29.945
11	31.845
15	32.865
10	33.915
12	34.94


TEMPERATURE IN C
60
50
40
30
20
0
2
4
6
8
10
12
TIME IN MINUTES
WITHOUT EXPLOSAFE: TEST 13
FILL - 76 PERCENT
Q IN - 65 KW/M SQ
THERMOCOUPLE NOS:
1. —— 36- HEIGHT 0 CM FROM BOTTOM ON M.S. SHELL (I)
2. —— 21- HEIGHT 2.71 CM FROM BOTTOM INSIDE VESSEL
3. —— 22- HEIGHT 6.75 CM FROM BOTTOM INSIDE VESSEL
4. —— 23- HEIGHT 10.19 CM FROM BOTTOM INSIDE VESSEL


TEMPERATURE IN C
60
50
40
30
20
0
2
4
6
8
10
12
TIME IN MINUTES
WITHOUT EXPLOSAFE: TEST 13
FILL = 76 PERCENT
Q IN = 65 KW/M SQ
THERMOCOUPLE NOS:
1 - - - 13 - HEIGHT 14.2 CM FROM BOTTOM INSIDE VESSEL
2 ——— 24 - HEIGHT 15.24 CM FROM BOTTOM INSIDE VESSEL
3 - · - 2 - HEIGHT 17.09 CM FROM BOTTOM INSIDE VESSEL
4 - · - · 7 - HEIGHT 20.005 CM FROM BOTTOM INSIDE VESSEL


TEMPERATURE IN C
60
50
40
30
20
0
2
4
6
8
10
12
TIME IN MINUTES
WITHOUT EXPLOSAFE: TEST 13
FILL = 76 PERCENT
Q IN = 65 KW/M SQ
THERMOCOUPLE NOS:
1 — · 8 - HEIGHT 21.98 CM FROM BOTTOM INSIDE VESSEL
2 —— 1 - HEIGHT 23.53 CM FROM BOTTOM INSIDE VESSEL
3 — · 6 - HEIGHT 24.97 CM FROM BOTTOM INSIDE VESSEL
4 — · 5 - HEIGHT 25.96 CM FROM BOTTOM INSIDE VESSEL


TEMPERATURE IN C
60
50
40
30
20
0
2
4
6
8
10
12
TIME IN MINUTES
WITHOUT EXPLOSAFE: TEST 13
FILL = 76 PERCENT
Q IN = 65 KW/M SQ
THERMOCOUPLE NOS:
1 — 4 - HEIGHT 26.99 CM FROM BOTTOM INSIDE VESSEL
2 —— 18 - HEIGHT 28.965 CM FROM BOTTOM INSIDE VESSEL
3 — 9 - HEIGHT 29.945 CM FROM BOTTOM INSIDE VESSEL
4 —— 11 - HEIGHT 31.045 CM FROM BOTTOM INSIDE VESSEL


80
70
60
50
40
30
20
TEMPERATURE IN C
0
2
4
6
8
10
12
TIME IN MINUTES
WITHOUT EXPLOSAFE: TEST 13
FILL. = 76 PERCENT
Q IN = 65 KW/M SQ
THERMOCOUPLE NOS:
1 ---- 11 - HEIGHT 31.845 CM FROM BOTTOM INSIDE VESSEL
2 —— 15 - HEIGHT 32.865 CM FROM BOTTOM INSIDE VESSEL
3 - - - 10 - HEIGHT 33.915 CM FROM BOTTOM INSIDE VESSEL
4 —— 12 - HEIGHT 34.94 CM FROM BOTTOM INSIDE VESSEL

FOLLOWING ARE HEIGHT VS TEMPERATURE

PLOTS FOR THE

THERMOCOUPLES PLACED AT THE CENTRE

OF THE VESSEL

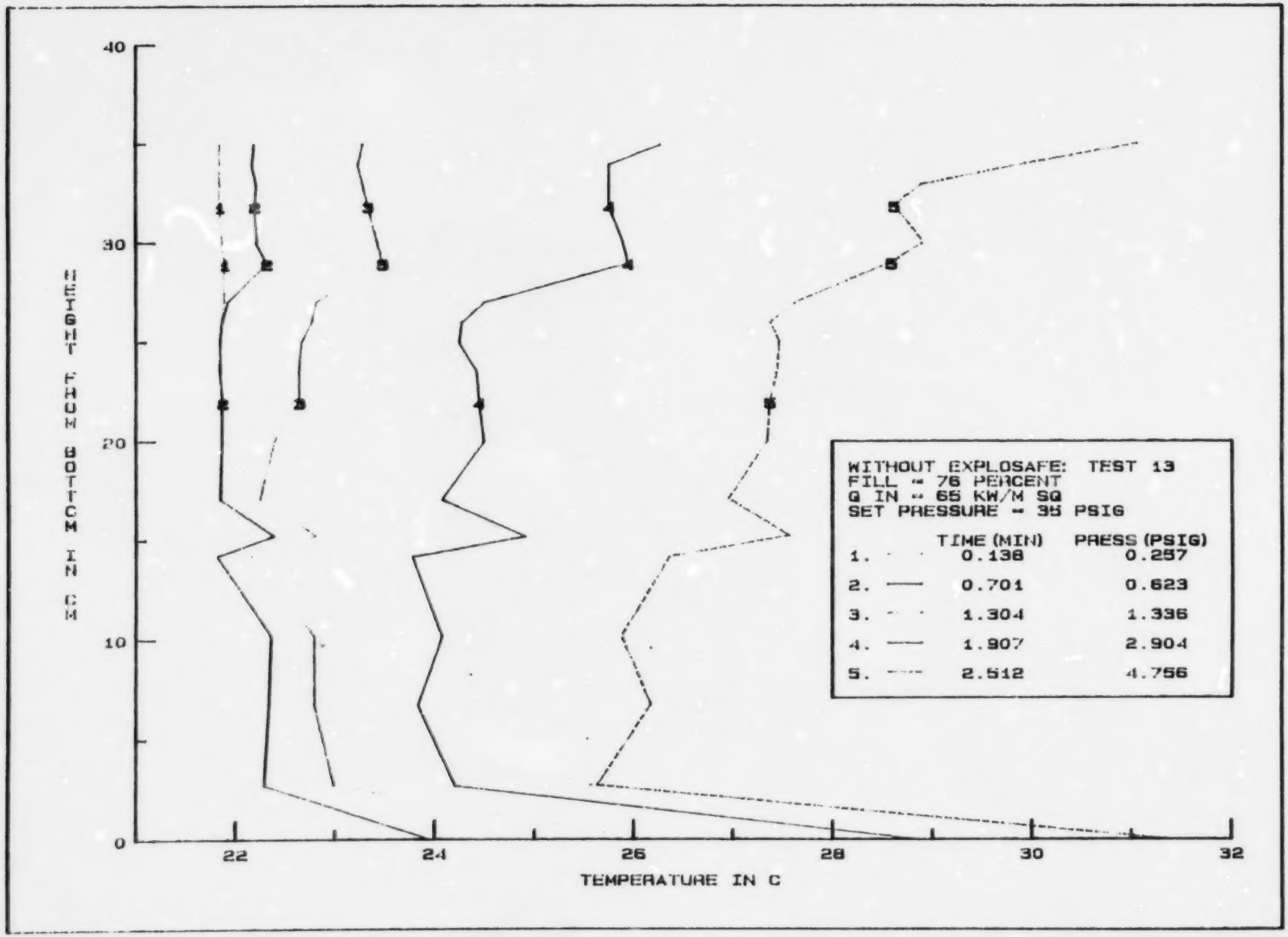
IN A VERTICAL AXIS

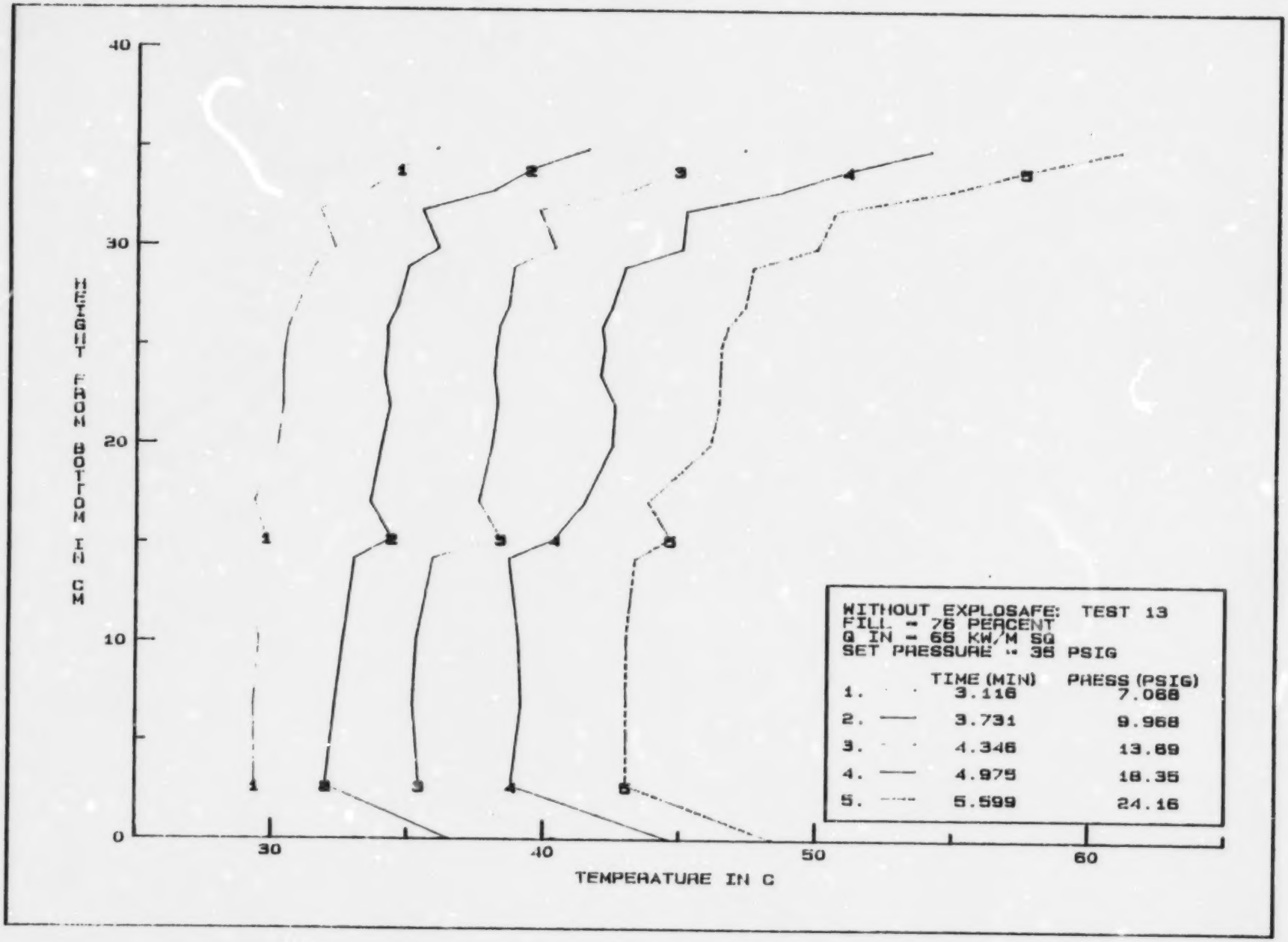
EACH PLOT REPRESENTS ONE SCAN OF

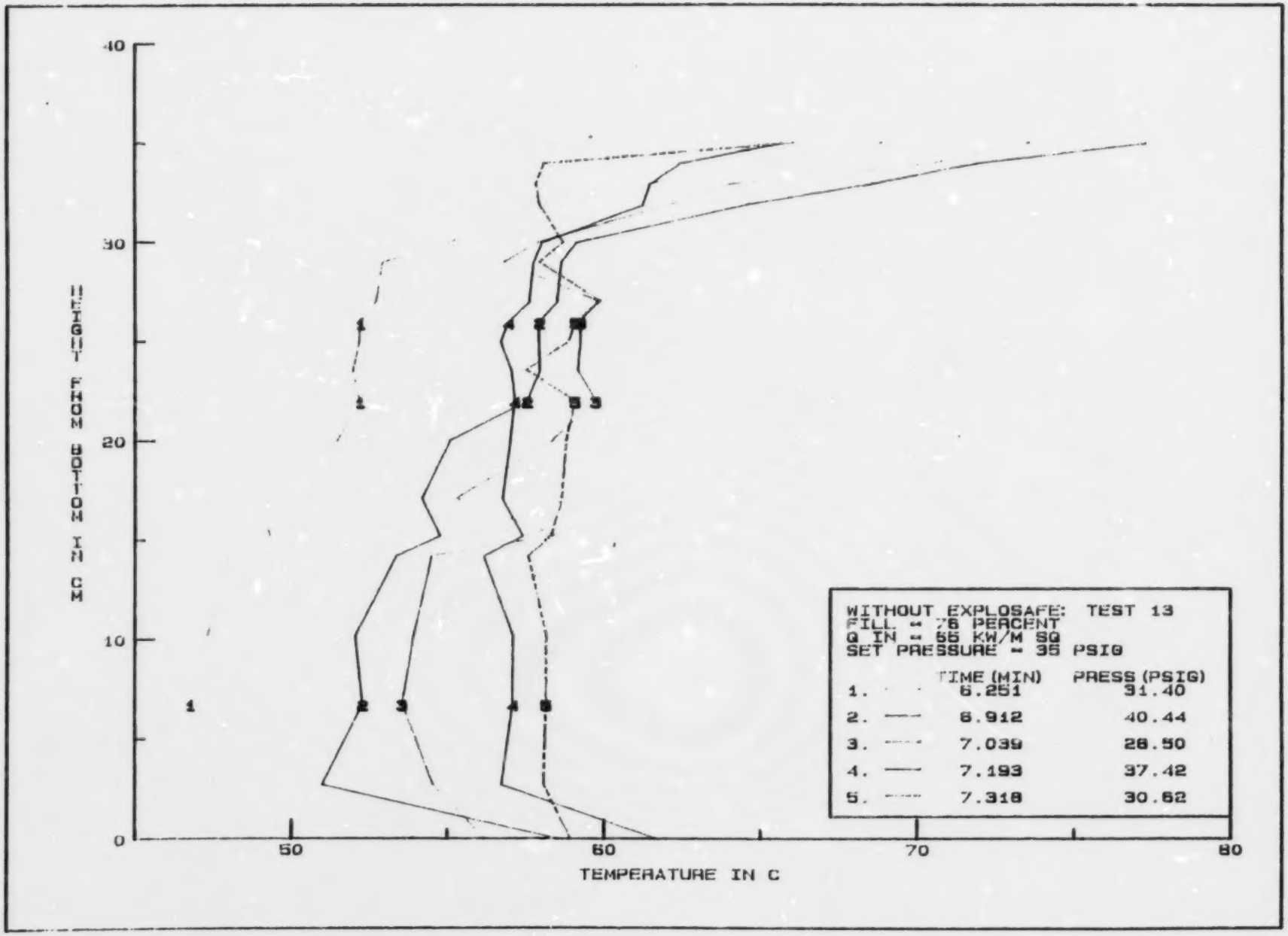
ALL THE THERMOCOUPLES

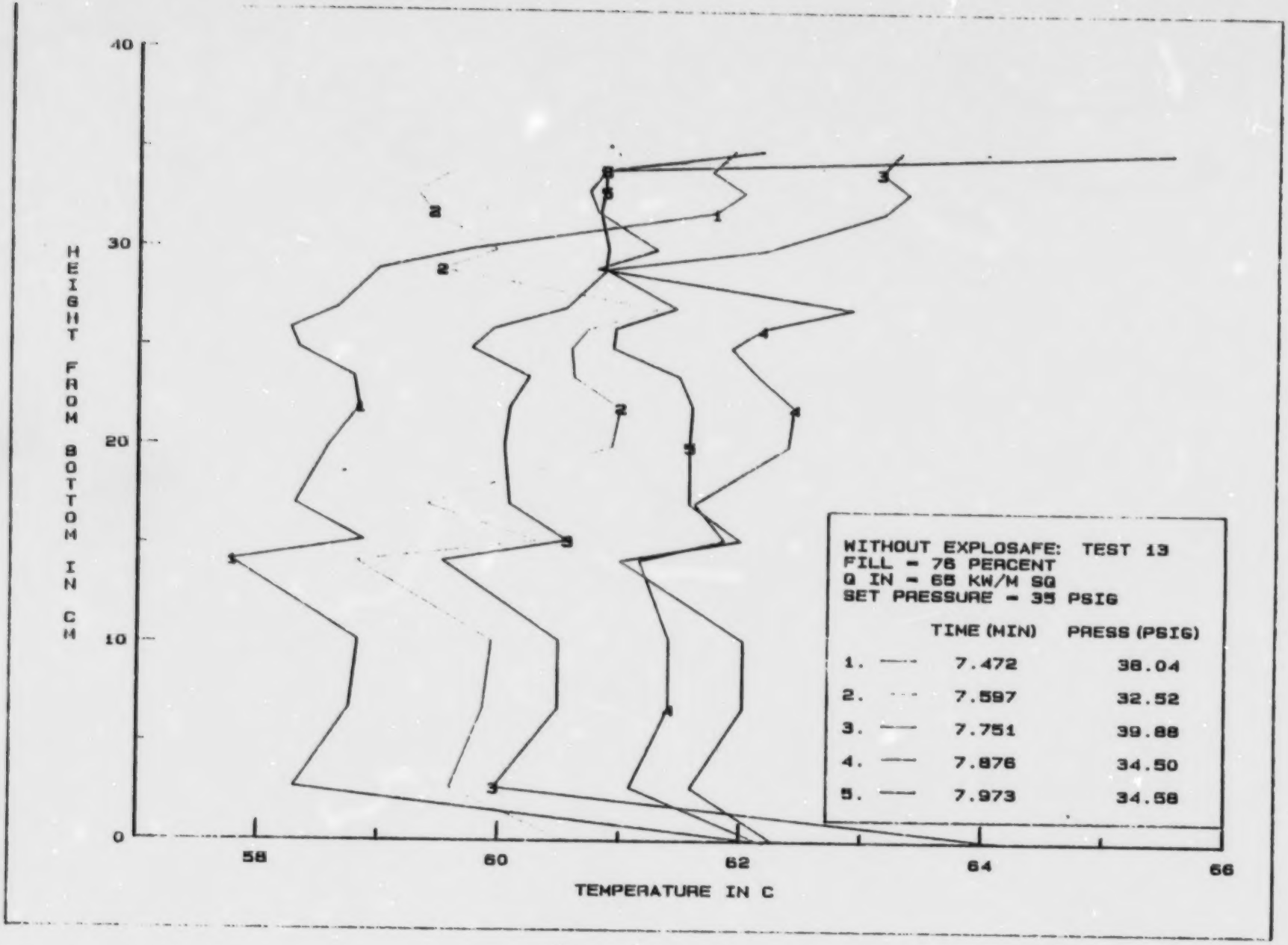
PLOTS ARE GIVEN AS FIVE (5) SCANS

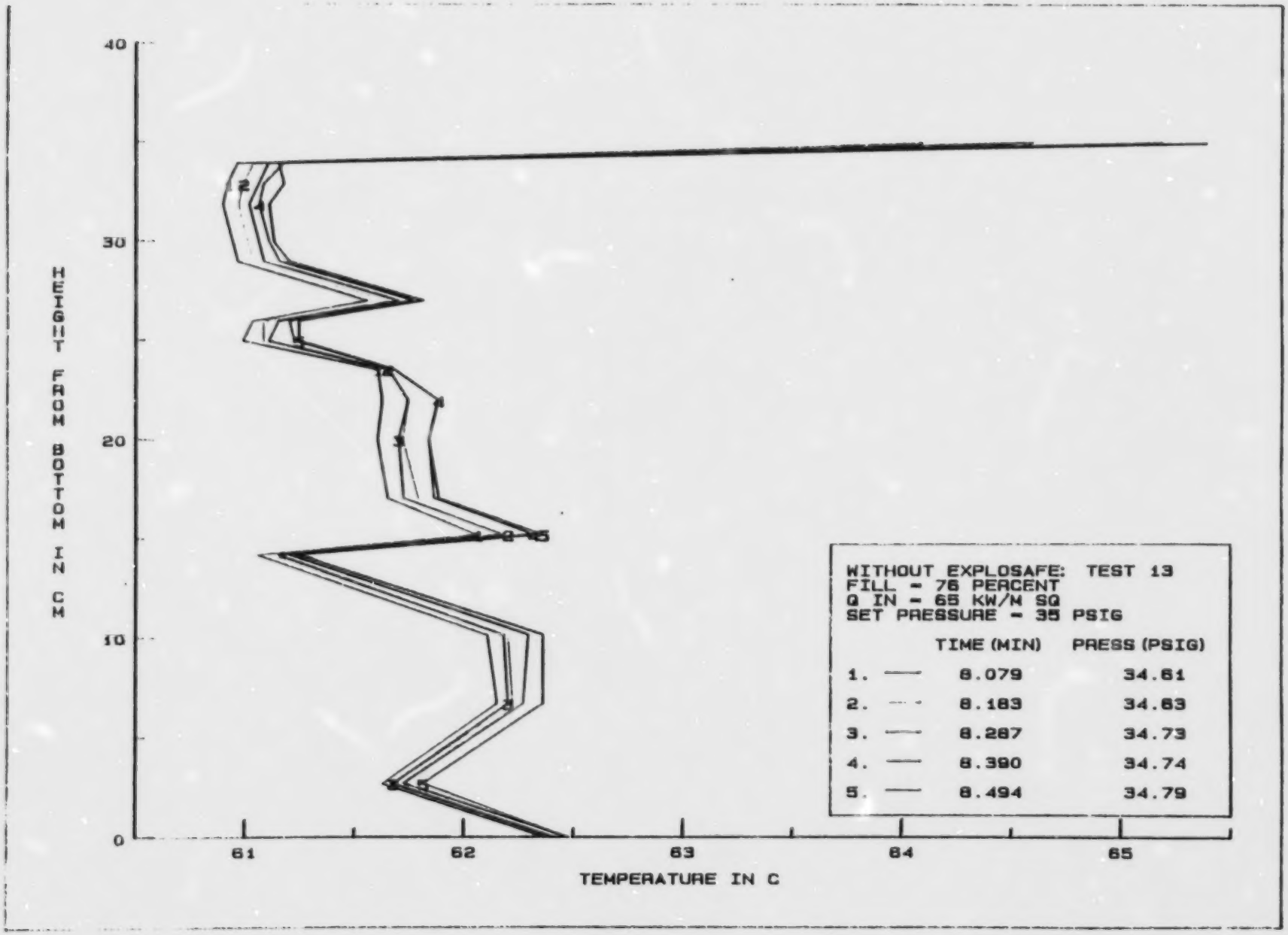
PER PAGE

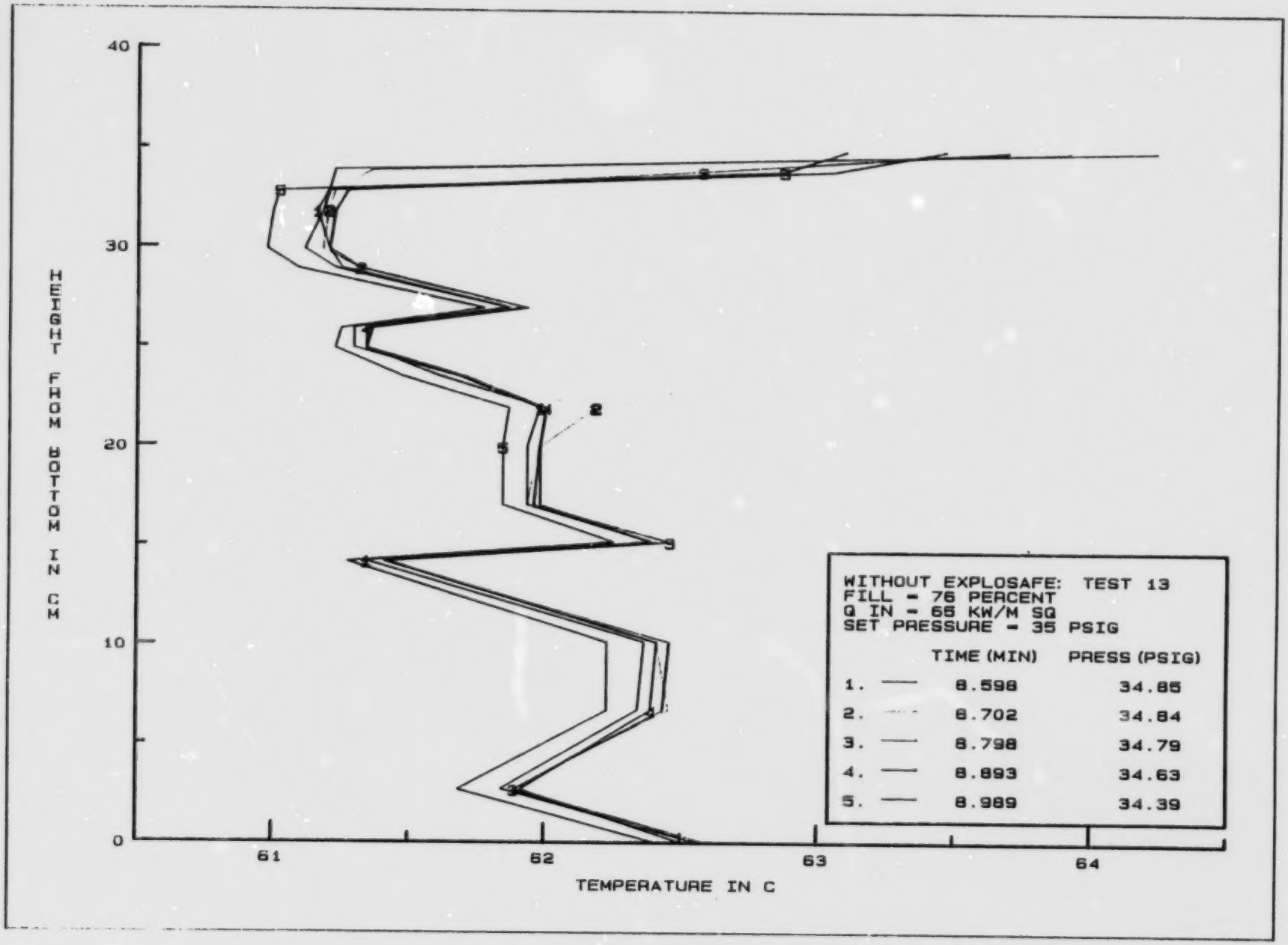

HEIGHT FROM BOTTOM IN CM
40
30
20
10
0
22
24
26
28
30
32
TEMPERATURE IN C
WITHOUT EXPLOSAFE: TEST 13
FILL = 76 PERCENT
Q IN = 65 KW/M SQ
SET PRESSURE = 35 PSIG
TIME (MIN) PRESS (PSIG)
1. 0.138 0.257
2. 0.701 0.623
3. 1.304 1.336
4. 1.907 2.904
5. 2.512 4.756

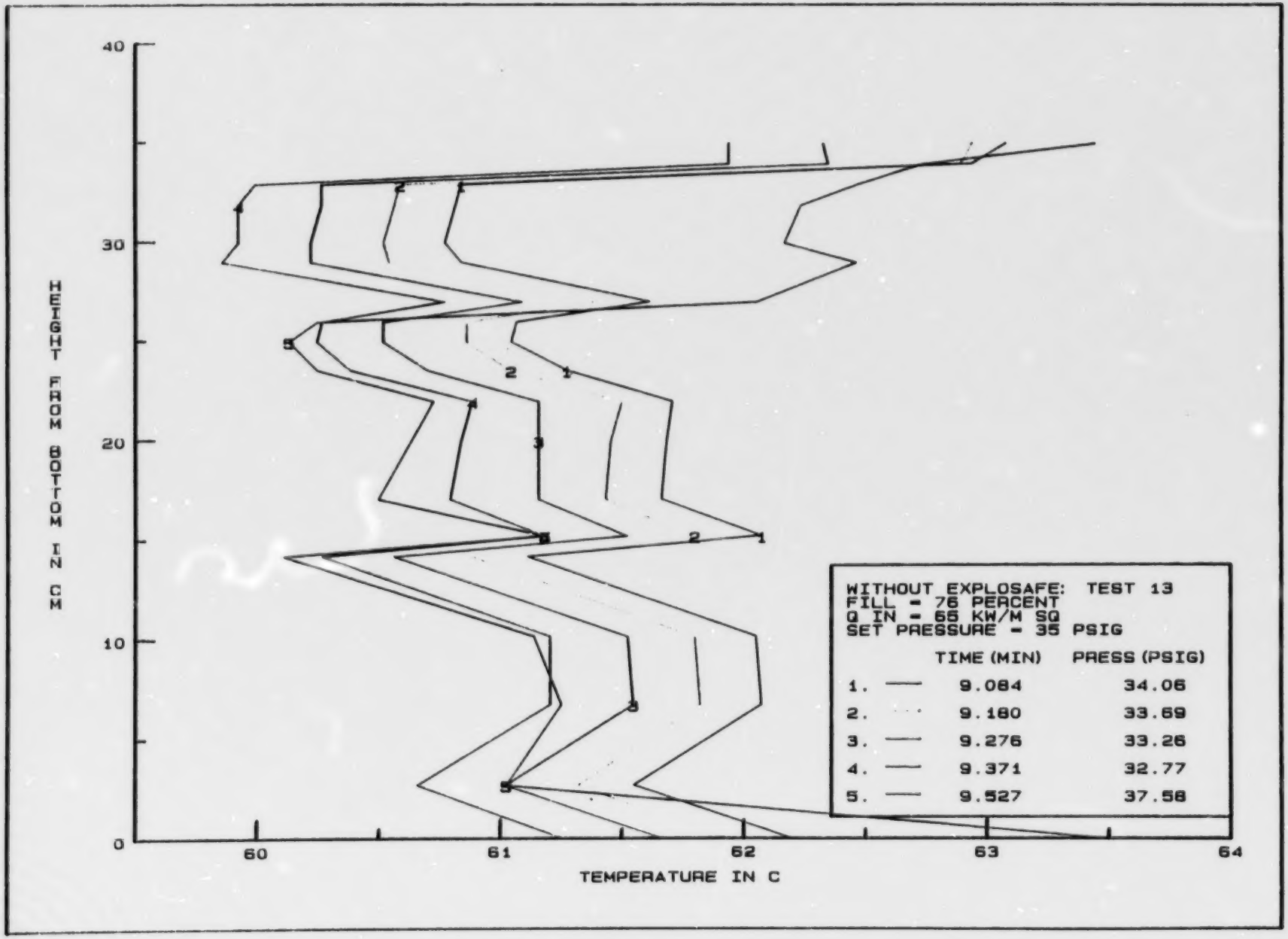

HEIGHT FROM BOTTOM IN CM
40
30
20
10
0
30
40
50
60
TEMPERATURE IN C
WITHOUT EXPLOSAFE: TEST 13
FILL = 76 PERCENT
Q IN = 65 KW/M SQ
SET PRESSURE = 35 PSIG
TIME (MIN) PRESS (PSIG)
1. 3.116 7.088
2. 3.731 9.968
3. 4.346 13.69
4. 4.975 18.35
5. 5.599 24.16

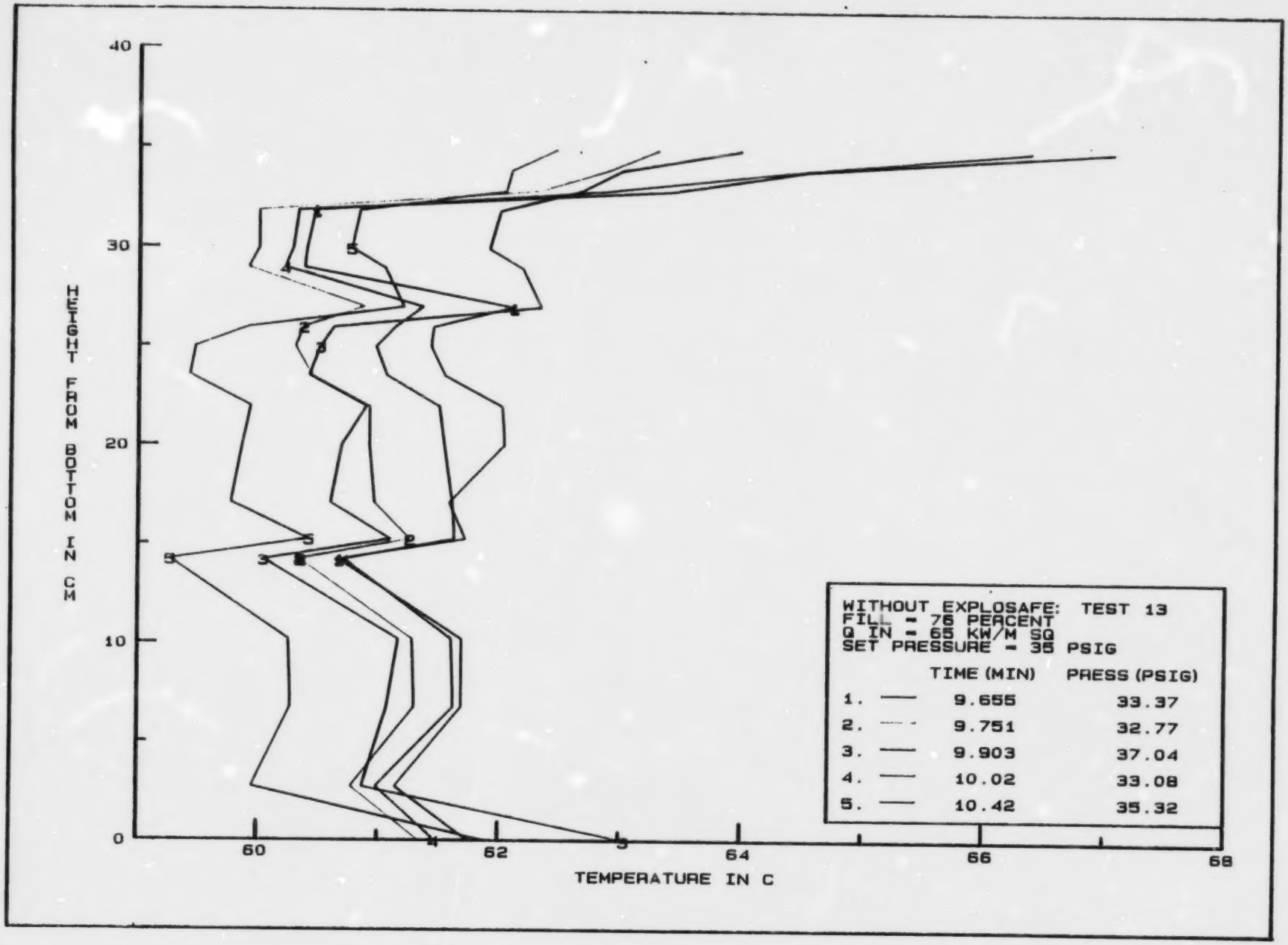

HEIGHT FROM BOTTOM IN CM
40
30
20
10
0
50
60
70
80
TEMPERATURE IN C
WITHOUT EXPLOSAFE: TEST 13
FILL = 76 PERCENT
Q IN = 65 KW/M SQ
SET PRESSURE = 35 PSIG
TIME (MIN) PRESS (PSIG)
1. 6.251 31.40
2. 6.912 40.44
3. 7.039 28.50
4. 7.193 37.42
5. 7.318 30.62


HEIGHT FROM BOTTOM IN CM
40
30
20
10
0
58
60
62
64
66
TEMPERATURE IN C
WITHOUT EXPLOSAFE: TEST 13
FILL - 76 PERCENT
Q IN - 65 KW/M SQ
SET PRESSURE - 35 PSIG
TIME (MIN) PRESS (PSIG)
1. 7.472 38.04
2. 7.597 32.52
3. 7.751 39.88
4. 7.876 34.50
5. 7.973 34.58


HEIGHT FROM BOTTOM IN CM
40
30
20
10
0
61
62
63
64
65
TEMPERATURE IN C
WITHOUT EXPLOSAFE: TEST 13
FILL - 76 PERCENT
Q IN - 65 KW/M SQ
SET PRESSURE - 35 PSIG
TIME (MIN) PRESS (PSIG)
1. 8.079 34.61
2. 8.183 34.63
3. 8.287 34.73
4. 8.390 34.74
5. 8.494 34.79

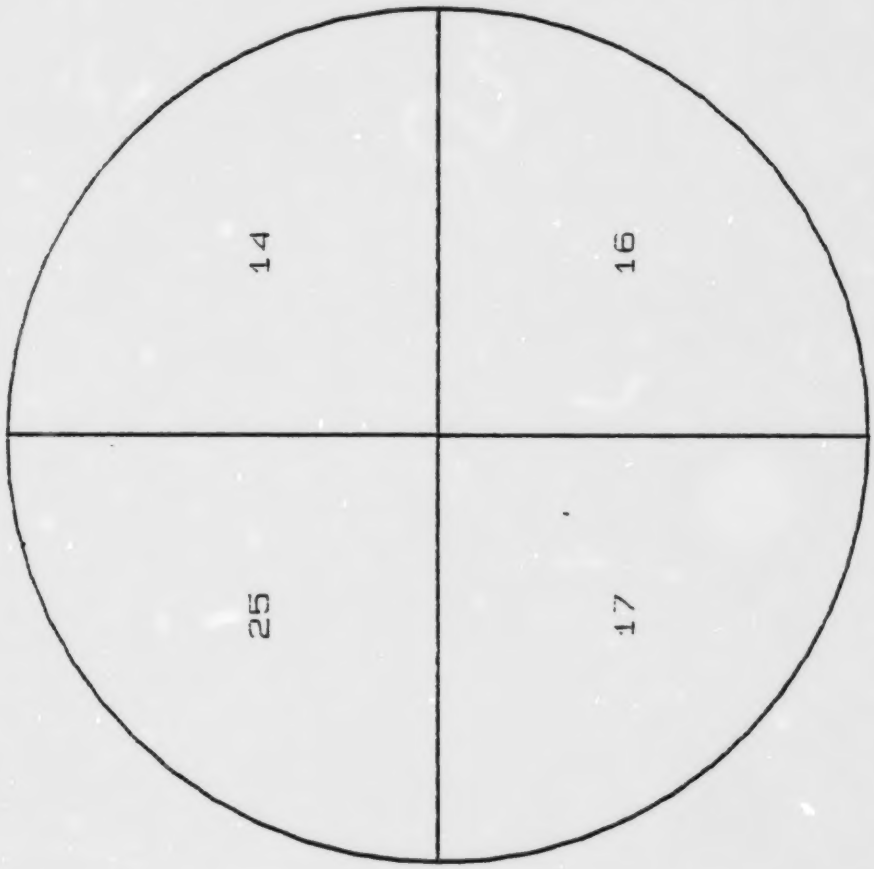

HEIGHT FROM BOTTOM IN CM
40
30
20
10
0
61
62
63
64
TEMPERATURE IN C
WITHOUT EXPLOSAFE: TEST 13
FILL - 76 PERCENT
Q IN - 65 KW/M SQ
SET PRESSURE - 35 PSIG
TIME (MIN) PRESS (PSIG)
1. 8.598 34.85
2. 8.702 34.84
3. 8.798 34.79
4. 8.893 34.63
5. 8.989 34.39


HEIGHT FROM BOTTOM IN CM
40
30
20
10
0
60
61
62
63
64
TEMPERATURE IN C
WITHOUT EXPLOSAFE: TEST 13
FILL = 76 PERCENT
Q IN = 65 KW/M SQ
SET PRESSURE = 35 PSIG
TIME (MIN) PRESS (PSIG)
1. 9.084 34.06
2. 9.180 33.69
3. 9.276 33.26
4. 9.371 32.77
5. 9.527 37.58


HEIGHT FROM BOTTOM IN CM
TEMPERATURE IN C
0
10
20
30
40
60
62
64
66
68
WITHOUT EXPLOSAFE: TEST 13
FILL - 76 PERCENT
Q IN - 65 KW/M SQ
SET PRESSURE - 35 PSIG
TIME (MIN) PRESS (PSIG)
1. 9.655 33.37
2. 9.751 32.77
3. 9.903 37.04
4. 10.02 33.08
5. 10.42 35.32

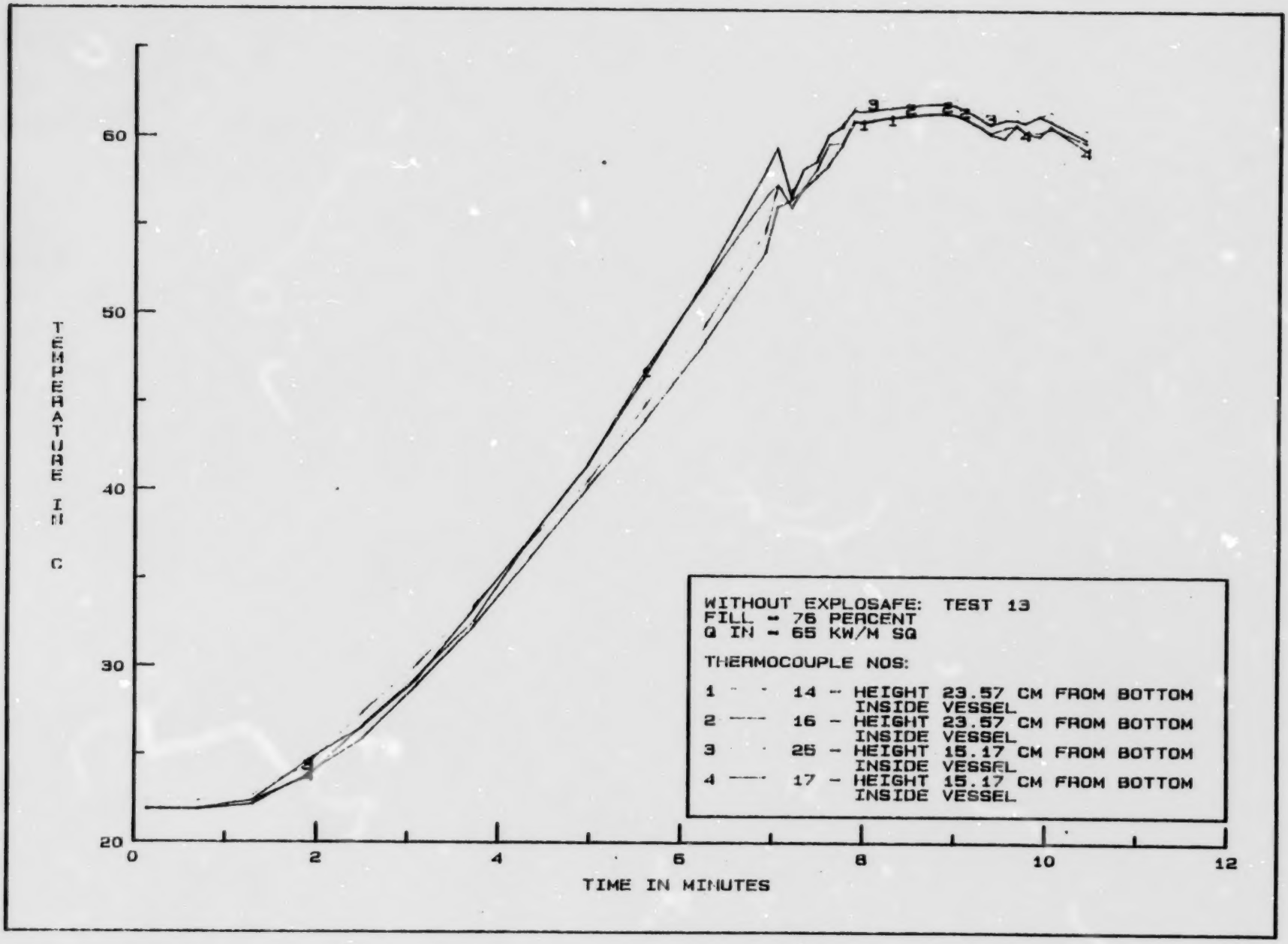
FOLLOWING FOUR THERMOCOUPLES ARE PLACED

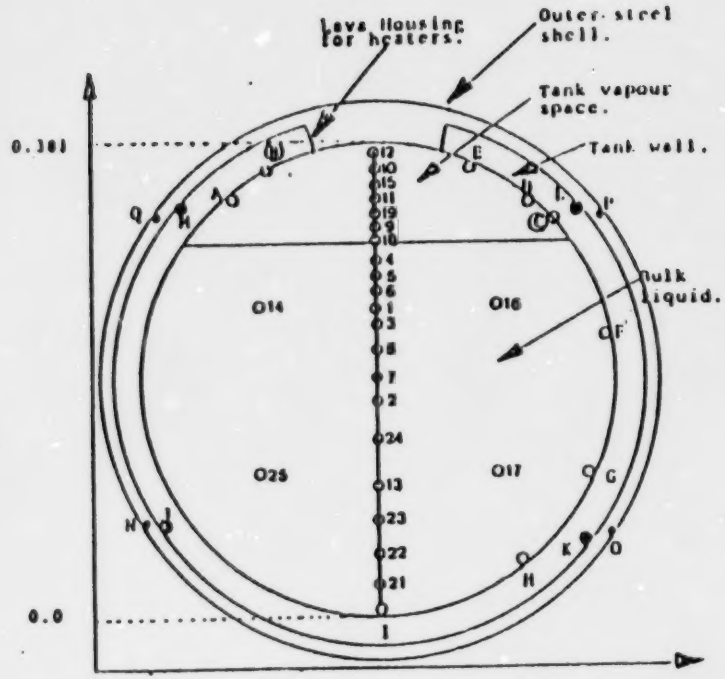
AT THE FOUR QUADRANTS ON A VERTICAL PLANE



THERMOCOUPLE NUM.	HEIGHT FROM BOTTOM IN CM
14 AND 16	23.57
25 AND 17	15.17

PLOTS ARE GIVEN TWO PER PAGE


TEMPERATURE IN C
60
50
40
30
20
0
2
4
6
8
10
12
TIME IN MINUTES
WITHOUT EXPLOSAFE: TEST 13
FILL - 76 PERCENT
Q IN - 65 KW/M SQ
THERMOCOUPLE NOS:
1 - - 14 - HEIGHT 23.57 CM FROM BOTTOM INSIDE VESSEL
2 —— 16 - HEIGHT 23.57 CM FROM BOTTOM INSIDE VESSEL
3 · 25 - HEIGHT 15.17 CM FROM BOTTOM INSIDE VESSEL
4 —· 17 - HEIGHT 15.17 CM FROM BOTTOM INSIDE VESSEL



SYMBOL	Thermocouple #.	Angle (Deg)
A	26	310
B	34	20
C	27	56
D & E	28 & 29	48 & 25
F & G	38 & 35	78 & 110
H & I	37 & 36	142 & 180
J & K	30 & 31	133 & 220
L & M	32 & 33	50 & 300
N & O	42 & 43	140 & 230
P & Q	39 & 41	60 & 310

○ Circled thermocouples are inserted inside the vapour space wall.

Number 44 represents pressure(vessel) in psig.
Number 45 represents time in seconds.
Reference upper diameter = 45.47 cms.

Thermocouple number#.	Height (cm)	Angle with the vertical (Deg.)	Doubtful or faulty Thermocouple.
12	42.57	-	-
10	41.545	-	-
15	40.495	-	-
11	39.475	-	-
19	38.55	-	YES.
09	37.575	-	-
18	36.595	-	-
04	34.62	-	-
05	33.59	-	-
06	32.60	-	-
01	31.16	-	-
03	30.63	-	YES.
08	29.61	-	-
07	27.635	-	-
02	24.72	-	-
24	22.87	-	-
13	21.83	-	-
23	17.82	-	-
22	14.38	-	-
21	10.34	-	-
36	07.63	180	-
26	-	310	-
27 & 28	-	56 & 48	-
29 & 38	-	25 & 78	-
35 & 37	-	110 & 142	-
30 & 31	-	133 & 220	-
33 & 34	-	300 & 20	YES.
32 & 39	-	50 & 60	-
41 & 42	-	310 & 140	-
43	-	230	-
14	31.2	-	-
16	31.2	-	-
25	22.8	-	-
17	22.8	-	-
20 & 40	Reference Temperature	-	-

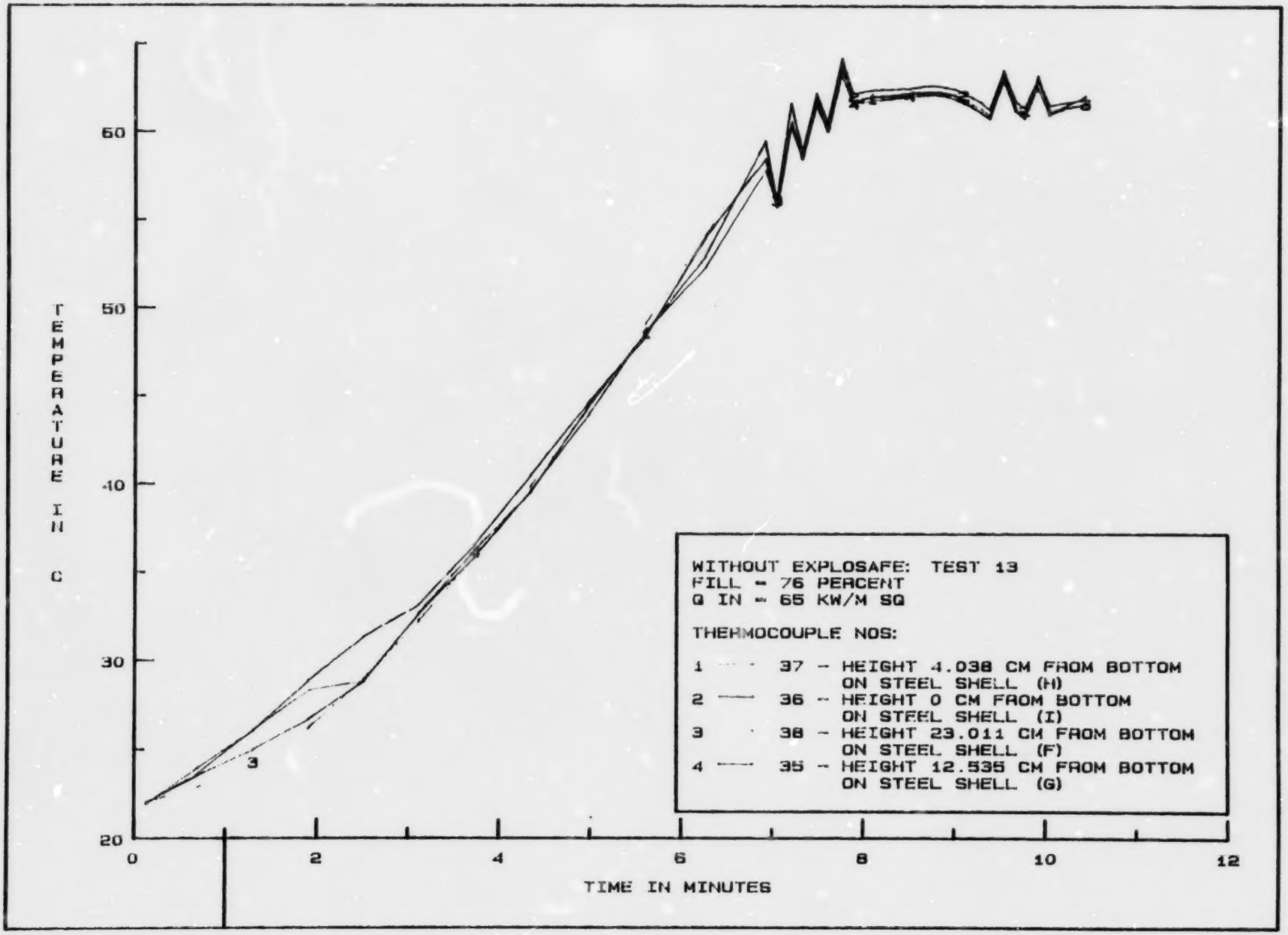
Fig. III.A A grid layout of thermocouples along with their locations for an unprotected vessel(UNB) with the PRV orifice of 1/4 in. (Valid for 76, 58 and 23 percent liquid full cases)

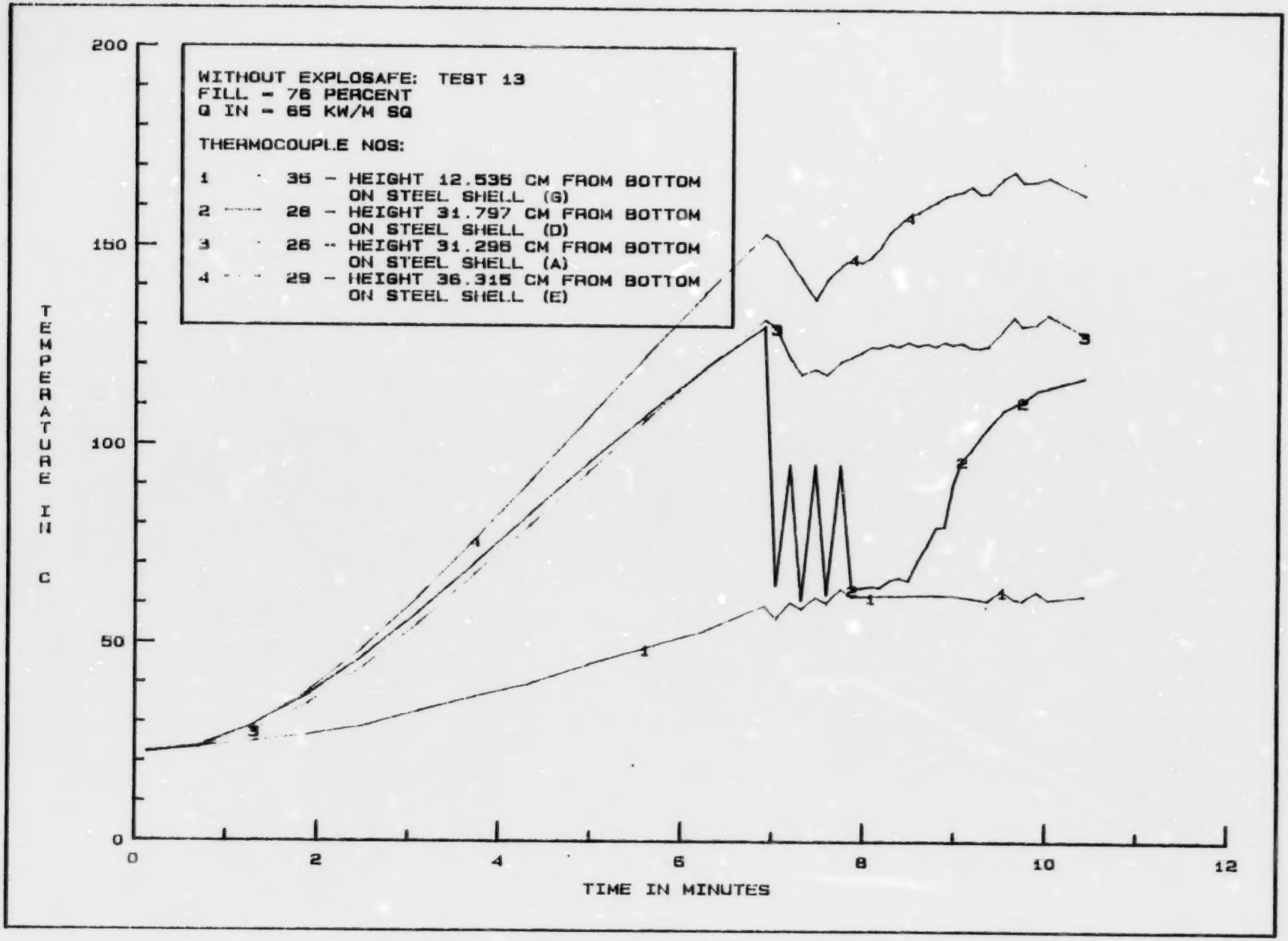
FOLLOWING THERMOCOUPLES ARE PLACED

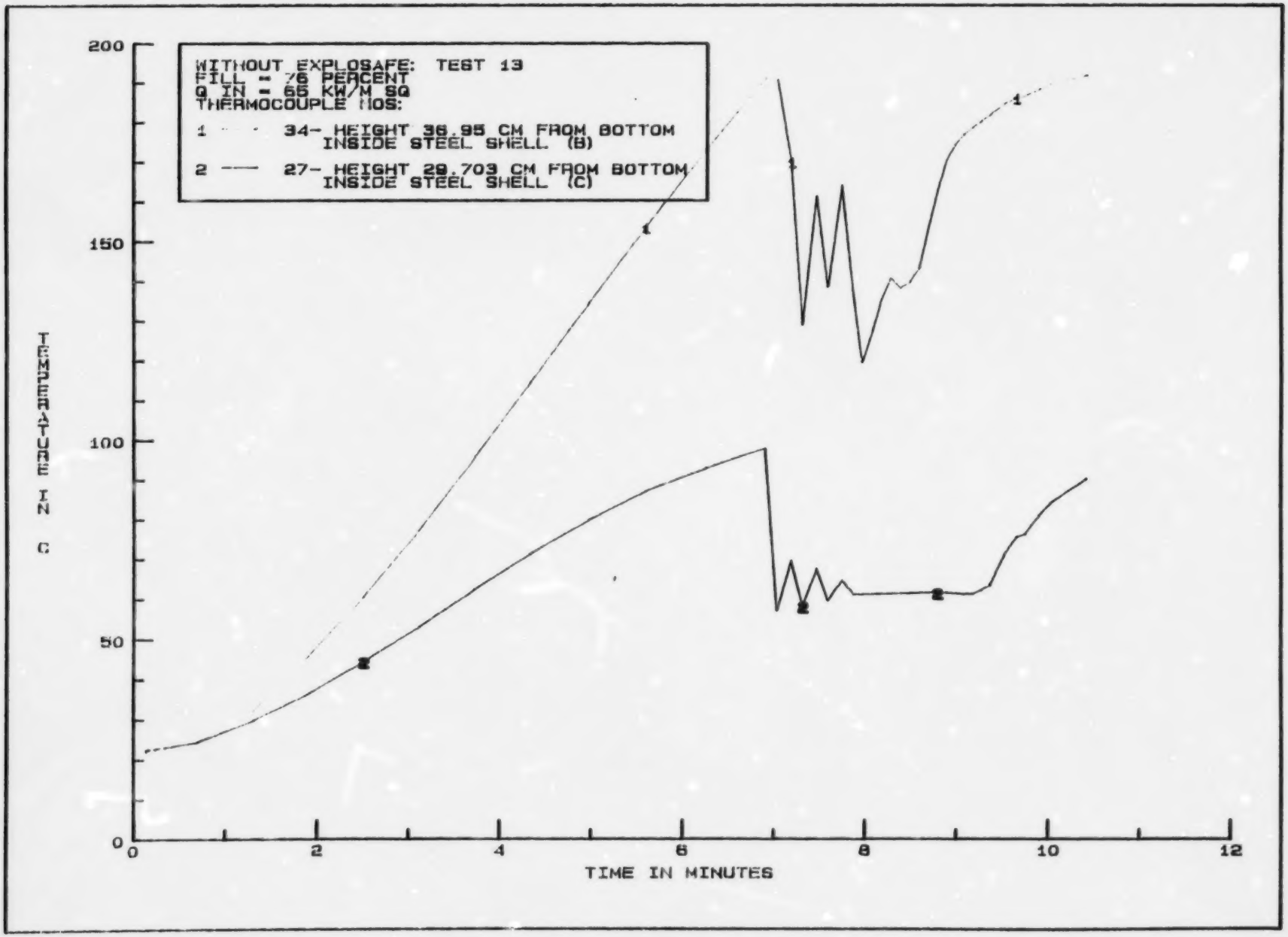
ON THE MILD STEEL SHELL OR

INSIDE THE MILD STEEL SHELL

THERMOCOUPLE NUM.	HEIGHT FROM BOTTOM IN CM
ON THE MILD STEEL SHELL:	
36 OR I	0
37 OR H	4.038
35 OR G	12.535
38 OR F	23.011
29 OR D	31.797
28 OR A	31.295
29 OR E	36.315
INSIDE THE MILD STEEL SHELL:	
34 OR B	36.95
27 OR C	29.703


TEMPERATURE IN C
60
50
40
30
20
0
2
4
6
8
10
12
TIME IN MINUTES
3
WITHOUT EXPLOSAFE: TEST 13
FILL = 76 PERCENT
Q IN = 65 KW/M SQ
THERMOCOUPLE NOS:
1 37 - HEIGHT 4.038 CM FROM BOTTOM ON STEEL SHELL (H)
2 36 - HEIGHT 0 CM FROM BOTTOM ON STEEL SHELL (I)
3 38 - HEIGHT 23.011 CM FROM BOTTOM ON STEEL SHELL (F)
4 35 - HEIGHT 12.535 CM FROM BOTTOM ON STEEL SHELL (G)


WITHOUT EXPLOSAFE: TEST 13
FILL - 76 PERCENT
Q IN - 65 KW/M SQ
THERMOCOUPLE NOS:
1 - 35 - HEIGHT 12.535 CM FROM BOTTOM ON STEEL SHELL (G)
2 - 28 - HEIGHT 31.797 CM FROM BOTTOM ON STEEL SHELL (D)
3 - 26 - HEIGHT 31.298 CM FROM BOTTOM ON STEEL SHELL (A)
4 - 29 - HEIGHT 36.315 CM FROM BOTTOM ON STEEL SHELL (E)
TEMPERATURE IN C
200
150
100
50
0
0
2
4
6
8
10
12
TIME IN MINUTES

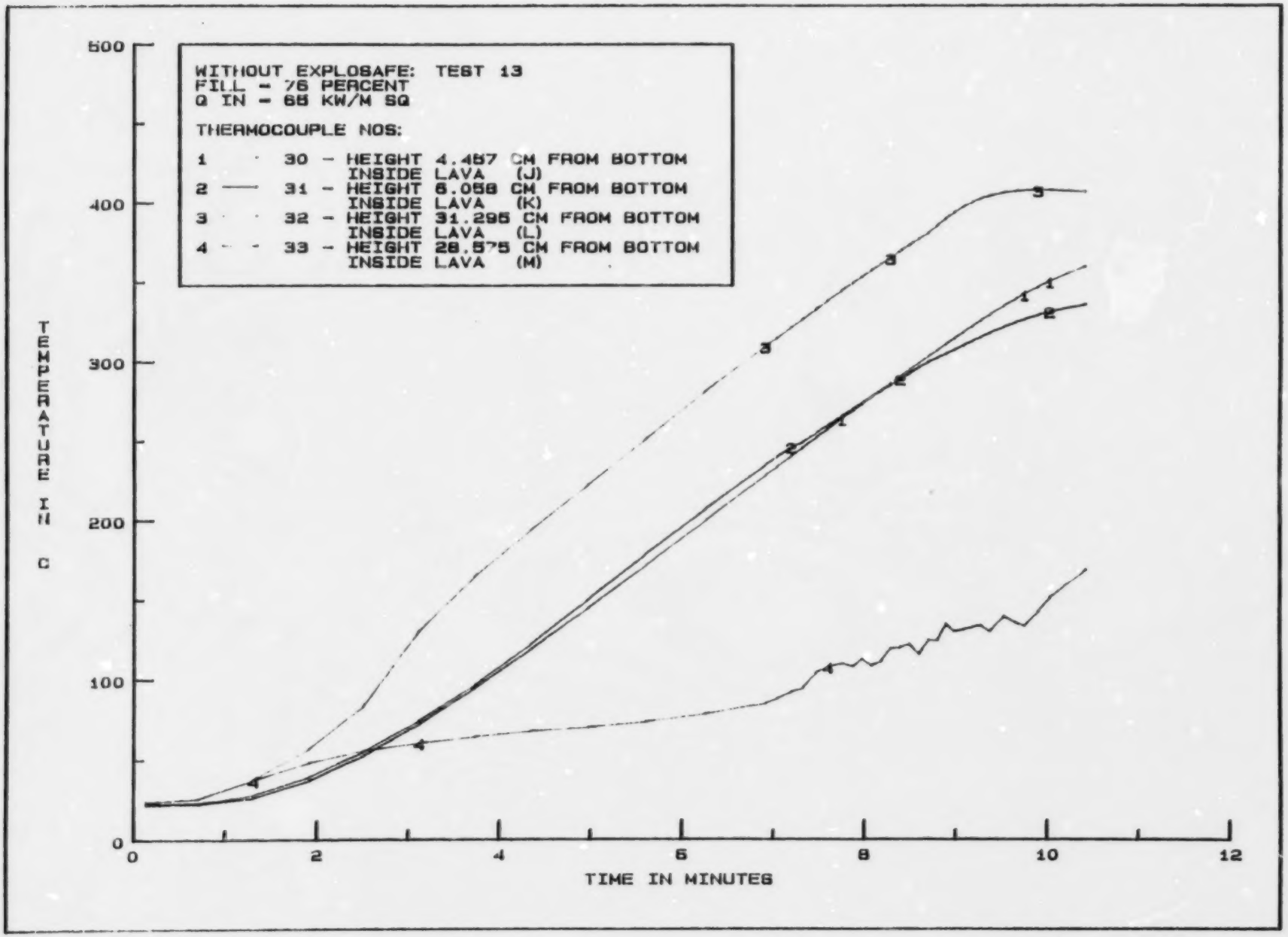

WITHOUT EXPLOSAFE: TEST 13
FILL = 76 PERCENT
Q IN = 65 KW/M SQ
THERMOCOUPLE NOS:
1 - - 34- HEIGHT 38.95 CM FROM BOTTOM INSIDE STEEL SHELL (B)
2 —— 27- HEIGHT 29.703 CM FROM BOTTOM INSIDE STEEL SHELL (C)
TEMPERATURE IN C
200
150
100
50
0
0
2
4
6
8
10
12
TIME IN MINUTES

FOLLOWING THERMOCOUPLES ARE PLACED

IN THE LAVA MEDIUM

THERMOCOUPLE NUM.	HEIGHT FROM BOTTOM IN CM
31 OR K	6.058
30 OR J	4.457
32 OR L	31.295
33 OR M	28.575

ALL ECHO PLOTS ARE GIVEN IN ONE PAGE

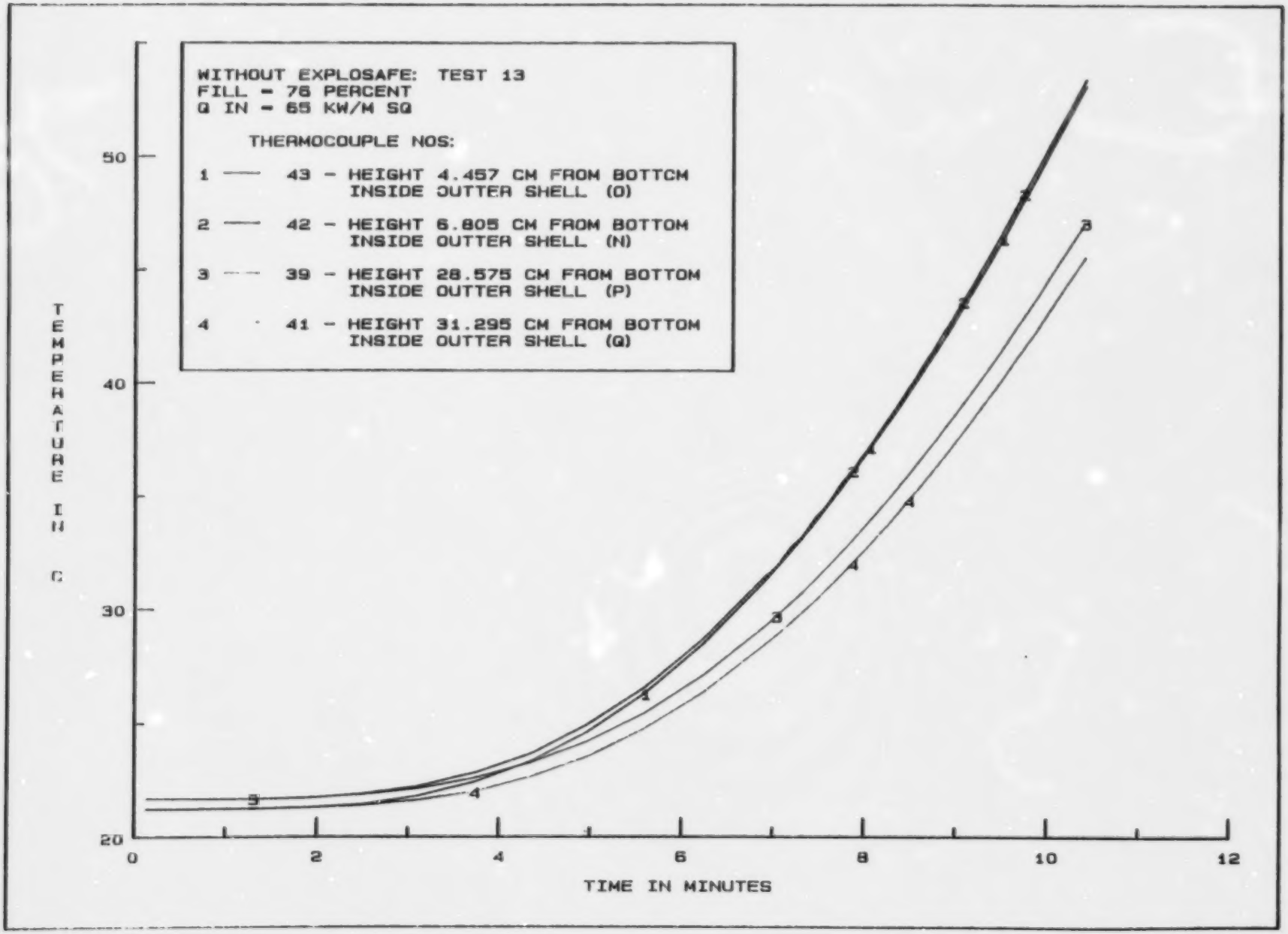

WITHOUT EXPLOSAFE: TEST 13
FILL - 76 PERCENT
Q IN - 65 KW/M SQ
THERMOCOUPLE NOS:
1 30 - HEIGHT 4.457 CM FROM BOTTOM INSIDE LAVA (J)
2 31 - HEIGHT 6.058 CM FROM BOTTOM INSIDE LAVA (K)
3 32 - HEIGHT 31.295 CM FROM BOTTOM INSIDE LAVA (L)
4 33 - HEIGHT 28.575 CM FROM BOTTOM INSIDE LAVA (M)
TEMPERATURE IN C
500
400
300
200
100
0
0
2
4
6
8
10
12
TIME IN MINUTES

FOLLOWING THERMOCOUPLES ARE PLACED

INSIDE THE OUTTER SHELL

THERMOCOUPLE NUM.	HEIGHT FROM BOTTOM IN CM
42 OR N	6.805
43 OR O	4.457
41 OR Q	31.295
39 OR P	28.575

ALL FOUR PLOTS ARE GIVEN IN ONE PAGE


WITHOUT EXPLOSAFE: TEST 13
FILL - 76 PERCENT
Q IN - 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 43 - HEIGHT 4.457 CM FROM BOTTCM INSIDE OUTTER SHELL (O)
2 —— 42 - HEIGHT 6.805 CM FROM BOTTOM INSIDE OUTTER SHELL (N)
3 — — 39 - HEIGHT 28.575 CM FROM BOTTOM INSIDE OUTTER SHELL (P)
4 · 41 - HEIGHT 31.295 CM FROM BOTTOM INSIDE OUTTER SHELL (Q)
TEMPERATURE IN C
50
40
30
20
0
2
4
6
8
10
12
TIME IN MINUTES

TEST 13

WITHOUT EXPLOSAFE

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITHOUT EXPLOSAFE - FILE NAME : TEST 13

DATE OF TEST JAN 13, 1984 Q IN = 65 KW/M SQ LIQUID LEVEL = 76 PERCENT

SET PRESSURE = 35 PSIG PRV ORIFICE DIAMETER = 1/4 INCHES

	TIME MINS	PRESSURE PSIG	THRM#1 C	THRM#2 C	THRM#3 C	THRM#4 C	THRM#5 C	THRM#6 C	THRM#7 C	THRM#8 C	THRM#9 C	THRM#10 C	THRM#11 C
1.	0.138	0.258	21.842	21.867	*******	21.892	21.867	21.818	21.867	21.867	21.867	21.842	21.842
2.	0.702	0.623	21.846	21.846	*******	21.921	21.871	21.846	21.871	21.871	22.217	22.168	22.193
3.	1.305	1.336	22.644	22.248	*******	22.817	22.767	22.668	22.396	22.644	23.434	23.236	23.335
4.	1.908	2.905	24.423	24.079	*******	24.497	24.276	24.251	24.497	24.448	25.898	25.751	25.751
5.	2.512	4.756	27.448	26.958	*******	27.643	27.374	27.472	27.350	27.374	28.913	29.936	28.620
6.	3.116	7.068	30.387	29.335	*******	30.867	30.551	30.430	30.187	30.381	32.226	34.642	31.692
7.	3.732	9.968	34.091	33.608	*******	34.573	34.212	34.212	34.019	34.308	36.066	39.394	35.464
8.	4.346	13.694	38.112	37.585	*******	38.638	38.303	38.207	36.064	38.255	40.332	44.861	39.736
9.	4.975	18.351	42.025	41.455	*******	42.429	42.073	42.168	42.476	42.571	45.007	51.058	45.149
10.	5.600	24.165	46.426	43.784	*******	47.319	46.684	46.449	46.073	46.379	49.942	57.571	50.619
11.	6.252	31.405	51.955	48.988	*******	52.699	52.211	52.165	51.466	52.188	55.064	64.552	57.349
12.	6.912	40.449	57.952	54.189	*******	58.503	57.929	57.906	56.092	57.537	59.100	71.089	64.534
13.	7.039	28.504	59.149	55.280	*******	59.791	59.241	59.241	58.345	59.722	57.862	70.545	62.101
14.	7.193	37.424	57.034	56.757	*******	57.609	56.941	56.688	57.011	57.149	58.000	62.397	61.233
15.	7.319	30.623	57.495	58.645	*******	59.861	59.081	58.852	58.783	59.058	58.668	58.047	57.909
16.	7.472	38.043	58.784	58.301	*******	58.646	58.255	58.324	58.577	58.030	59.724	61.737	61.760
17.	7.598	32.522	60.596	59.382	*******	61.305	60.711	60.574	60.917	60.985	59.955	59.589	59.428
18.	7.751	39.886	60.230	60.070	*******	60.828	59.932	59.749	60.024	60.070	62.173	63.130	63.153
19.	7.877	34.503	62.129	61.604	*******	62.904	62.152	61.901	62.380	62.426	61.284	60.850	60.781
20.	7.974	34.580	61.469	61.560	*******	61.446	60.943	60.920	61.560	61.583	60.875	60.852	60.806
21.	8.079	34.619	61.606	61.652	*******	61.560	61.035	60.989	61.606	61.629	60.943	60.966	60.898
22.	8.183	34.636	61.653	61.790	*******	61.653	61.081	61.081	61.721	61.744	61.013	61.036	60.967
23.	8.287	34.700	61.655	61.723	*******	61.700	61.152	61.106	61.700	61.746	61.060	61.106	61.015
24.	8.391	34.747	61.677	61.860	*******	61.769	61.198	61.220	61.837	61.883	61.106	61.175	61.060
25.	8.495	34.790	61.679	61.883	*******	61.814	61.243	61.243	61.837	61.883	61.129	61.152	61.106
26.	8.599	34.855	61.679	61.930	*******	61.862	61.291	61.291	61.930	61.976	61.199	61.222	61.154
27.	8.702	34.846	61.702	61.930	*******	61.908	61.359	61.337	61.976	62.181	61.177	61.359	61.199
28.	8.798	34.790	61.704	61.955	*******	61.932	61.361	61.338	61.978	62.001	61.201	62.571	61.224
29.	8.894	34.631	61.613	61.978	*******	61.864	61.338	61.338	61.978	62.001	61.110	63.049	61.178
30.	8.989	34.391	61.476	61.842	*******	61.773	61.248	61.225	61.842	61.865	60.974	62.868	60.996
31.	9.085	34.064	61.272	61.660	*******	61.614	61.065	61.043	61.683	61.706	60.769	62.937	60.814
32.	9.181	33.695	61.045	61.434	*******	61.388	60.862	60.862	61.456	61.502	60.519	62.894	60.565
33.	9.276	33.269	60.701	61.158	*******	61.090	60.518	60.518	61.158	61.158	60.220	62.346	60.266
34.	9.372	32.771	60.382	60.794	*******	60.771	60.268	60.245	60.840	60.886	59.924	61.937	59.924
35.	9.527	37.583	60.247	60.499	*******	62.053	60.247	60.132	60.636	60.728	62.167	62.737	62.235
36.	9.655	33.377	61.529	61.574	*******	62.099	61.437	61.414	62.031	62.008	60.385	64.399	60.454
37.	9.751	32.775	60.432	60.958	*******	60.867	60.363	60.295	60.912	60.912	59.997	62.876	59.997
38.	9.903	37.046	60.411	60.594	*******	62.330	60.617	60.502	60.686	60.891	61.897	62.991	61.988
39.	10.029	33.089	61.051	61.600	*******	61.349	61.120	60.950	61.531	61.486	60.274	64.515	60.319
40.	10.421	35.327	59.430	59.774	*******	61.193	59.912	59.476	59.866	59.935	60.759	62.084	60.827

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITHOUT EXPLOSAFE - FILE NAME : TEST 13

DATE OF TEST JAN 13, 1984 Q IN = 65 KW/M SQ LIQUID LEVEL = 76 PERCENT

SET PRESSURE = 35 PSIG PRV ORIFICE DIAMETER = 1/4 INCHES

	TIME MINS	PRESSURE PSIG	THRM#12 C	THRM#13 C	THRM#14 C	THRM#15 C	THRM#16 C	THRM#17 C	THRM#18 C	THRM#19 C	THRM#20 C	THRM#21 C	THRM#22 C
1.	0.138	0.258	21.842	21.818	21.842	21.842	21.867	21.842	21.892	864.730	2.480	22.288	22.337
2.	0.702	0.623	22.193	21.822	21.871	22.217	21.871	21.846	22.316	880.900	2.481	22.292	22.341
3.	1.305	1.336	23.286	22.149	22.347	23.286	22.347	22.174	23.483	929.140	2.481	22.989	22.792
4.	1.908	2.905	26.266	23.783	23.684	25.751	24.645	23.857	25.947	*******	2.482	24.202	23.832
5.	2.512	4.756	31.079	26.370	26.615	28.889	26.542	25.904	28.596	*******	2.482	25.634	26.174
6.	3.116	7.068	35.990	28.725	29.432	33.508	29.286	28.993	31.474	*******	2.483	29.359	29.310
7.	3.732	9.968	41.514	33.028	32.569	38.104	33.246	32.302	34.959	*******	2.483	31.987	32.326
8.	4.346	13.694	47.262	35.905	37.225	43.159	37.225	36.170	38.829	*******	2.484	35.424	35.185
9.	4.975	18.351	54.079	38.690	41.455	48.674	41.431	40.170	42.903	*******	2.485	38.810	39.168
10.	5.600	24.165	61.058	43.334	46.849	54.802	46.520	43.996	47.601	*******	2.485	43.026	43.002
11.	6.252	31.405	68.828	47.984	51.792	61.386	51.978	48.453	52.908	*******	2.486	47.538	46.763
12.	6.912	40.449	77.286	53.377	56.639	68.495	58.113	53.563	58.641	*******	2.486	50.982	52.286
13.	7.039	28.504	73.525	54.493	57.356	63.991	59.447	56.088	56.780	*******	2.487	54.516	53.543
14.	7.193	37.424	65.649	56.157	56.019	61.462	56.619	56.526	57.747	*******	2.487	56.711	57.080
15.	7.319	30.623	66.012	57.564	57.127	57.794	58.185	57.081	57.909	*******	2.487	58.047	58.139
16.	7.472	36.043	61.920	57.772	58.278	62.011	58.692	57.841	58.990	*******	2.487	58.301	58.761
17.	7.598	32.522	64.018	58.808	59.634	59.290	60.093	58.464	59.497	*******	2.487	59.589	59.864
18.	7.751	39.886	63.290	59.520	59.703	63.358	60.711	59.657	60.871	*******	2.487	59.955	60.462
19.	7.877	34.503	65.541	61.147	60.896	60.713	61.536	60.987	60.781	*******	2.487	61.079	61.399
20.	7.974	34.680	62.154	60.989	60.875	60.852	61.446	60.852	60.852	*******	2.488	61.583	62.017
21.	8.079	34.619	64.090	61.058	61.012	60.920	61.538	60.989	60.966	*******	2.488	61.629	62.154
22.	8.183	34.636	65.226	61.127	61.081	60.990	61.630	61.104	61.036	*******	2.488	61.675	62.223
23.	8.287	34.700	65.387	61.152	61.129	61.060	61.677	61.175	61.083	*******	2.488	61.677	62.202
24.	8.391	34.747	65.183	61.198	61.198	61.083	61.746	61.220	61.152	*******	2.488	61.723	62.271
25.	8.495	34.790	64.592	61.243	61.266	61.175	61.769	61.243	61.198	*******	2.488	61.814	62.362
26.	8.599	34.855	64.231	61.337	61.291	61.199	61.862	61.337	61.245	*******	2.488	61.839	62.341
27.	8.702	34.846	63.913	61.428	61.359	61.222	61.908	61.359	61.314	*******	2.488	61.862	62.455
28.	8.798	34.790	63.687	61.407	61.361	61.270	61.909	61.407	61.316	*******	2.488	61.887	62.434
29.	8.894	34.631	63.459	61.407	61.338	61.201	61.887	61.384	61.224	*******	2.488	61.909	62.389
30.	8.989	34.391	63.096	61.271	61.248	61.019	61.773	61.271	61.088	*******	2.488	61.682	62.230
31.	9.085	34.064	63.074	61.112	61.066	60.837	61.569	61.089	60.837	*******	2.488	61.546	62.071
32.	9.181	33.695	62.939	60.885	60.816	60.587	61.319	60.816	60.542	*******	2.489	61.319	61.822
33.	9.276	33.269	62.323	60.564	60.541	60.266	61.021	60.564	60.220	*******	2.489	61.021	61.547
34.	9.372	32.771	61.937	60.268	60.245	59.993	60.703	60.199	59.856	*******	2.489	60.657	61.206
35.	9.527	37.583	63.443	60.109	60.567	62.463	61.002	59.972	62.463	*******	2.489	61.025	61.253
36.	9.655	33.377	66.372	60.660	60.603	62.852	61.003	60.751	60.362	*******	2.489	61.140	61.688
37.	9.751	32.775	63.286	60.340	60.317	62.306	60.798	60.295	59.905	*******	2.489	60.775	61.301
38.	9.903	37.046	63.970	60.044	60.274	62.650	61.234	60.090	62.171	*******	2.489	60.869	61.074
39.	10.029	33.089	67.054	60.708	60.548	63.401	60.914	60.686	60.205	*******	2.489	60.983	61.623
40.	10.421	35.327	62.449	59.270	59.682	62.038	59.809	59.316	61.033	*******	2.490	59.958	60.278

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITHOUT EXPLOSAFE - FILE NAME : TEST 13

DATE OF TEST JAN 13, 1984 Q IN = 65 KW/M SQ LIQUID LEVEL = 76 PERCENT

SET PRESSURE = 35 PSIG PRV ORIFICE DIAMETER = 1/4 INCHES

	TIME MINS	PRESSURE PSIG	THRM#23 C	THRM#24 C	THRM#25 C	THRM#26 C	THRM#27 C	THRM#28 C	THRM#29 C	THRM#30 C	THRM#31 C	THRM#32 C	THRM#33 C
1.	0.138	0.258	22.362	22.386	22.362	22.395	22.414	22.434	22.007	21.814	21.814	23.789	23.112
2.	0.702	0.623	22.366	22.390	22.366	23.369	24.453	24.047	23.621	22.052	22.982	25.400	25.690
3.	1.305	1.336	22.792	22.817	22.693	27.681	29.819	29.376	29.241	26.041	28.144	37.489	37.432
4.	1.908	2.908	24.079	24.915	24.448	34.664	36.521	37.133	37.878	36.598	39.349	56.506	48.230
5.	2.512	4.756	25.879	27.570	27.389	43.887	44.591	46.737	48.822	52.416	55.267	83.395	55.945
6.	3.116	7.068	29.529	29.749	30.162	54.783	53.236	57.817	61.595	71.982	74.648	130.200	60.769
7.	3.732	9.968	32.641	34.381	33.463	67.111	62.783	70.064	75.938	94.630	97.026	164.900	64.751
8.	4.346	13.694	35.328	38.375	37.178	79.627	71.826	82.782	90.908	119.080	122.810	193.870	68.258
9.	4.975	18.351	39.049	40.361	40.527	92.907	80.152	95.545	106.800	145.170	151.050	222.340	70.599
10.	5.600	24.165	43.002	44.611	44.894	106.090	87.424	107.470	122.270	171.710	179.260	250.830	73.944
11.	6.252	31.405	47.303	49.319	49.412	119.230	93.123	119.430	138.050	199.840	207.400	280.980	78.826
12.	6.912	40.449	52.053	54.768	54.768	131.760	98.272	130.190	153.440	228.210	235.050	309.480	85.271
13.	7.039	28.504	53.914	58.437	57.241	129.810	57.250	64.595	151.590	233.570	240.180	314.490	88.363
14.	7.193	37.424	57.103	57.402	57.011	122.180	69.873	95.271	146.280	240.240	246.250	321.130	92.374
15.	7.319	30.623	58.139	58.300	58.760	117.830	58.420	80.921	142.020	245.460	249.800	326.250	94.829
16.	7.472	38.043	58.830	58.875	58.944	119.330	67.856	95.328	136.820	252.070	255.260	332.840	104.790
17.	7.598	32.522	59.932	60.299	60.230	117.780	59.813	82.386	141.950	257.260	260.020	338.110	108.290
18.	7.751	39.886	60.482	60.551	60.642	121.190	65.014	95.202	145.470	263.830	265.810	344.450	110.240
19.	7.877	34.503	61.399	61.855	61.764	122.420	61.340	83.873	147.540	269.000	270.480	349.380	108.150
20.	7.974	34.580	62.017	61.994	61.994	123.480	61.376	84.134	146.200	273.040	274.010	353.130	113.220
21.	8.079	34.619	62.108	62.063	62.017	125.010	61.453	84.549	147.680	277.440	277.910	357.170	108.550
22.	8.183	34.636	62.200	62.200	62.155	124.770	61.529	84.175	150.330	281.740	281.590	361.150	111.760
23.	8.287	34.700	62.180	62.180	62.225	125.810	61.604	86.160	154.010	286.010	285.290	365.080	119.770
24.	8.391	34.747	62.294	62.316	62.202	125.050	61.662	86.816	156.240	290.310	289.960	369.070	120.400
25.	8.495	34.790	62.362	62.362	62.271	126.310	61.701	85.939	158.200	294.550	292.600	373.010	122.660
26.	8.599	34.855	62.364	62.387	62.341	125.290	61.777	71.025	159.100	298.760	296.220	376.940	118.940
27.	8.702	34.846	62.409	62.409	62.367	125.930	61.816	74.997	160.600	302.970	299.790	380.630	124.760
28.	8.798	34.790	62.457	62.457	62.389	125.090	61.816	79.369	161.740	306.790	302.380	385.000	124.470
29.	8.894	34.631	62.411	62.389	62.343	126.350	61.741	79.796	163.100	310.620	304.890	389.530	134.890
30.	8.989	34.391	62.230	62.253	62.230	126.490	61.537	90.581	163.840	314.400	307.490	393.560	130.050
31.	9.085	34.064	62.048	62.071	62.025	126.130	61.331	96.485	164.370	318.180	310.190	396.950	131.580
32.	9.181	33.695	61.799	61.799	61.776	124.870	61.425	99.028	165.650	321.910	312.840	399.840	133.000
33.	9.276	33.269	61.524	61.524	61.501	124.670	62.477	102.060	163.720	325.560	315.470	402.070	134.200
34.	9.372	32.771	61.206	61.183	61.183	125.200	63.735	104.730	163.920	329.130	317.980	403.810	130.020
35.	9.527	37.583	61.139	61.185	61.185	129.000	71.351	108.880	167.610	334.690	321.780	405.950	139.890
36.	9.655	33.377	61.688	61.711	61.666	132.660	75.658	110.640	169.360	339.030	324.660	406.900	135.610
37.	9.751	32.775	61.278	61.256	61.232	130.200	76.458	111.660	166.670	342.110	326.600	407.290	133.500
38.	9.903	37.046	61.166	61.097	61.211	130.860	81.069	114.100	166.940	346.660	329.380	407.550	142.870
39.	10.029	33.089	61.600	61.628	61.531	133.260	84.243	114.890	167.980	350.180	331.400	407.440	151.550
40.	10.421	35.327	60.255	60.416	60.438	128.240	90.443	117.450	163.490	359.600	336.160	406.010	169.010

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITHOUT EXPLOSAFE - FILE NAME : TEST 13

DATE OF TEST JAN 13, 1984 Q IN = 65 KW/M SQ LIQUID LEVEL = 76 PERCENT

SET PRESSURE = 35 PSIG PRV ORIFICE DIAMETER = 1/4 INCHES

	TIME MINS	PRESSURE PSIG	THRM#34 C	THRM#35 C	THRM#36 C	THRM#37 C	THRM#38 C	THRM#39 C	THRM#40 C	THRM#41 C	THRM#42 C	THRM#43 C
1.	0.130	0.258	21.969	21.988	21.910	21.988	22.046	21.678	2.435	21.261	21.678	21.232
2.	0.702	0.623	24.588	23.543	23.950	23.679	22.905	21.684	2.436	21.257	21.664	21.218
3.	1.305	1.336	32.375	24.998	26.041	26.138	24.341	21.707	2.436	21.281	21.668	21.242
4.	1.908	2.905	46.086	26.704	28.865	28.343	26.222	21.772	2.437	21.307	21.734	21.307
5.	2.512	4.756	60.913	28.849	31.350	28.868	28.965	21.894	2.437	21.409	21.913	21.467
6.	3.116	7.068	77.552	32.682	33.142	32.701	32.279	22.153	2.438	21.629	22.250	21.823
7.	3.732	9.968	95.939	36.270	36.557	35.926	35.926	22.603	2.438	22.003	22.836	22.429
8.	4.346	13.694	114.890	39.582	40.498	39.659	39.907	23.288	2.439	22.649	23.675	23.346
9.	4.975	18.351	134.470	44.405	44.633	43.968	44.462	24.241	2.440	23.545	24.976	24.647
10.	5.600	24.165	153.700	48.605	48.378	48.700	49.154	25.484	2.440	24.789	26.604	26.334
11.	6.252	31.405	173.050	52.925	53.982	52.339	54.077	27.171	2.441	26.399	28.770	28.559
12.	6.912	40.449	191.390	59.488	58.492	57.869	59.582	29.277	2.441	28.449	31.469	31.277
13.	7.039	28.504	191.120	56.082	56.139	55.724	56.214	29.740	2.442	28.854	31.893	31.855
14.	7.193	37.424	170.260	60.375	61.633	60.694	60.488	30.300	2.442	29.395	32.759	32.567
15.	7.319	30.623	129.010	58.552	58.891	58.590	58.458	30.762	2.442	29.858	33.220	33.163
16.	7.472	38.043	161.840	61.635	62.198	61.936	61.579	31.378	2.442	30.417	34.103	33.931
17.	7.598	32.522	138.480	60.132	60.565	60.076	60.020	31.897	2.442	30.917	34.640	34.583
18.	7.751	39.866	164.450	63.796	64.190	63.796	63.308	32.553	2.442	31.535	35.581	35.390
19.	7.877	34.503	136.750	61.715	62.147	61.734	61.621	33.092	2.443	32.056	36.158	35.081
20.	7.974	34.580	119.620	61.883	62.277	61.883	61.733	33.532	2.442	32.477	36.731	36.616
21.	8.079	34.619	127.160	61.979	62.378	62.017	61.829	34.014	2.443	32.920	37.287	37.211
22.	8.183	34.636	135.360	62.036	62.412	62.074	61.867	34.494	2.443	33.382	37.919	37.785
23.	8.287	34.700	141.030	62.074	62.412	62.093	61.924	34.992	2.443	33.842	38.530	38.377
24.	8.391	34.747	138.270	62.094	62.469	62.187	61.981	35.491	2.443	34.341	39.142	38.970
25.	8.495	34.790	139.880	62.171	62.471	62.246	62.058	35.990	2.443	34.842	39.793	39.602
26.	8.599	34.855	143.500	62.228	62.566	62.303	62.096	36.527	2.443	35.321	40.423	40.232
27.	8.702	34.846	154.020	62.248	62.642	62.323	62.135	37.064	2.443	35.839	41.110	40.882
28.	8.798	34.790	163.050	62.248	62.604	62.304	62.116	37.541	2.443	36.318	41.720	41.472
29.	8.894	34.631	170.580	62.172	62.510	62.210	62.060	38.057	2.443	36.796	42.348	42.082
30.	8.989	34.391	174.520	62.082	62.419	62.082	61.875	38.557	2.443	37.296	42.960	42.694
31.	9.085	34.064	177.090	61.725	62.194	61.856	61.669	39.072	2.443	37.793	43.607	43.341
32.	9.181	33.695	178.930	61.425	61.932	61.576	61.425	39.589	2.444	38.310	44.255	43.988
33.	9.276	33.269	180.440	61.125	61.670	61.313	61.144	40.123	2.444	38.825	44.920	44.635
34.	9.372	32.771	182.070	60.770	61.258	60.920	60.770	40.659	2.444	39.343	45.568	45.283
35.	9.527	37.583	184.870	63.531	63.512	63.156	63.025	41.556	2.444	40.203	46.708	46.386
36.	9.655	33.377	186.280	61.242	61.749	61.393	61.242	42.357	2.444	40.967	47.677	47.373
37.	9.751	32.775	186.850	60.792	61.336	61.017	60.848	42.909	2.444	41.500	48.378	48.056
38.	9.903	37.046	188.480	63.233	63.045	62.952	62.558	43.823	2.444	42.377	49.497	49.175
39.	10.029	33.089	189.940	60.983	61.472	61.209	61.040	44.644	2.444	43.160	50.465	50.162
40.	10.421	35.327	192.000	62.092	61.886	61.585	61.698	47.075	2.445	45.518	53.376	53.093

PLOTS OF A TEST

CARRIED OUT ON THE UNB TANK 2

WITHOUT EXPLOSAFE

TEST NUMBER 14

Q in = 65 kW/m sq

LIQUID LEVEL = 58 %

SET PRESSURE = 35 psig

PRV ORIFICE DIAMETER = 1/4 in.

Date of Test JAN 17, 1984

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Thermocouple Grid Layout - - - - - - - - - - -

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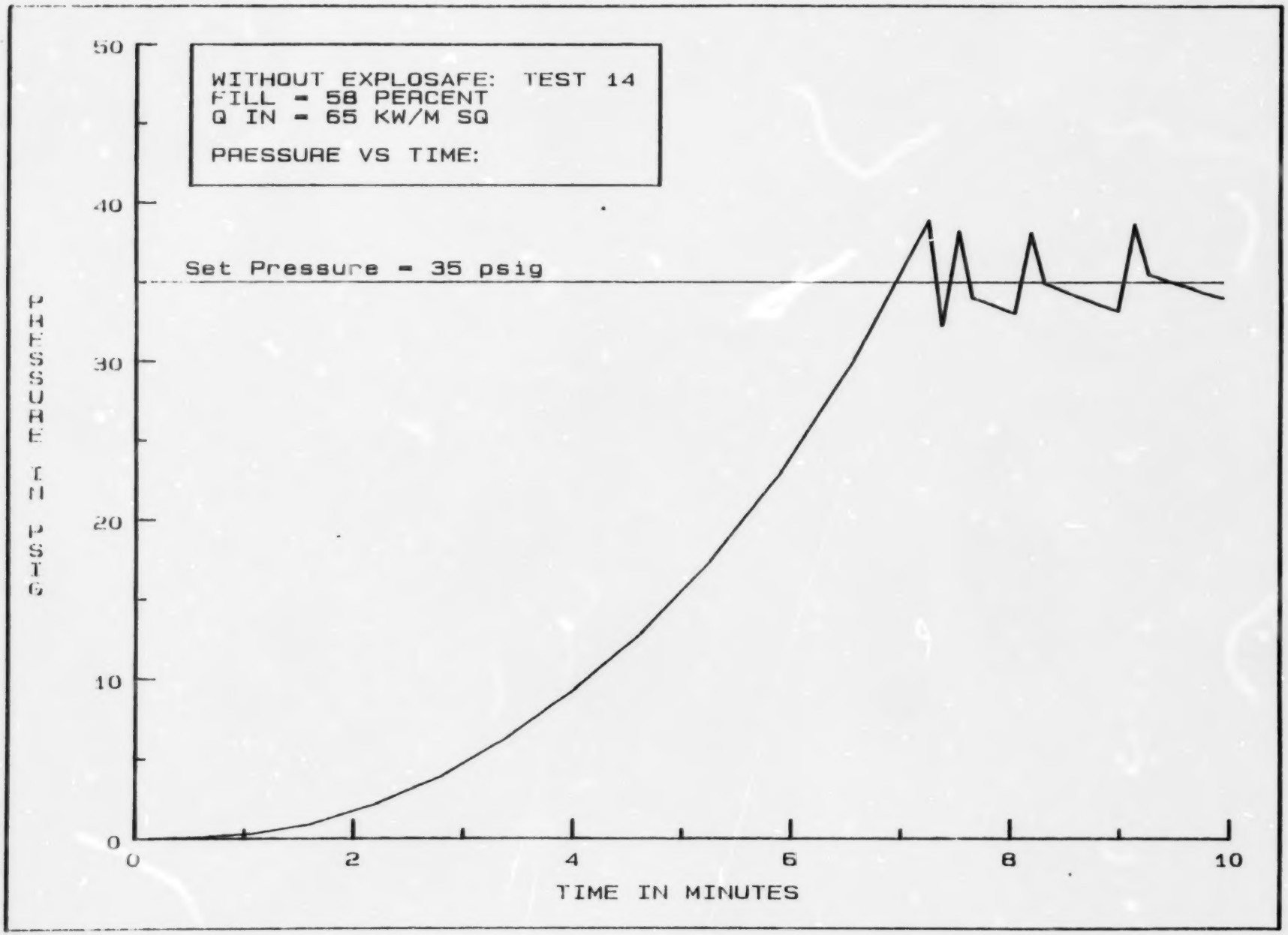
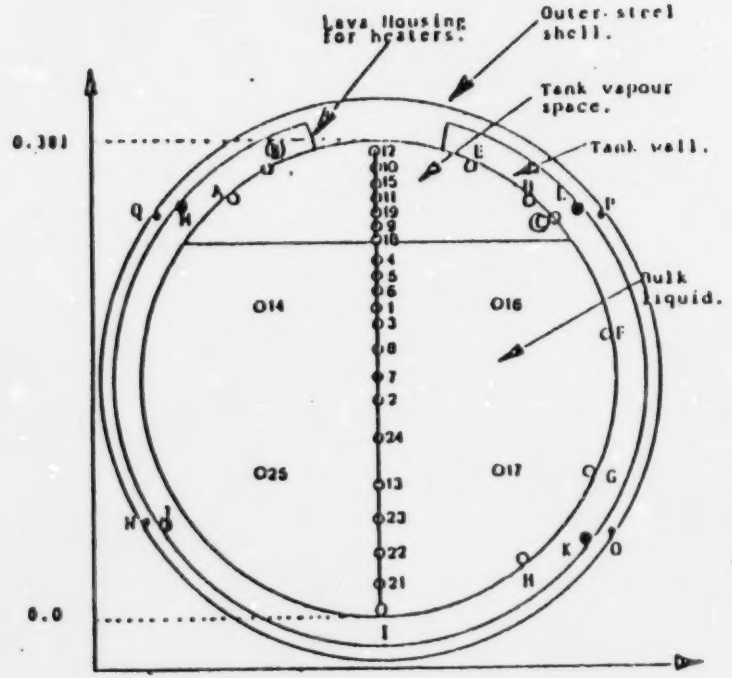

WITHOUT EXPLOSAFE: TEST 14
FILL = 58 PERCENT
Q IN = 65 KW/M SQ
PRESSURE VS TIME:
Set Pressure = 35 psig
PRESSURE IN PSIG
50
40
30
20
10
0
0
2
4
6
8
10
TIME IN MINUTES



SYMBOL	Thermocouple #.	Angle (Deg)
A	26	310
B	34	20
C	27	56
D & E	28 & 29	48 & 25
F & G	38 & 35	78 & 110
H & I	37 & 36	142 & 180
J & K	30 & 31	133 & 220
L & M	32 & 33	50 & 300
N & O	42 & 43	140 & 230
P & Q	39 & 41	60 & 310

○ Circled thermocouples are inserted inside the vapour space wall.

Number 44 represents pressure(vessel) in psig.
Number 45 represents time in seconds.
Reference upper diameter = 45.47 cms.

Thermocouple numbers.	Height (cm)	Angle with the vertical (Deg.)	Doubtful or faulty Thermocouple.
12	42.57	-	-
10	41.545	-	-
15	40.495	-	-
11	39.475	-	-
19	38.55	-	YES.
09	37.575	-	-
18	36.595	-	-
04	34.62	-	-
05	33.59	-	-
06	32.60	-	-
01	31.16	-	-
03	30.63	-	YES.
08	29.61	-	-
07	27.635	-	-
02	24.72	-	-
24	22.87	-	-
13	21.83	-	-
23	17.82	-	-
22	14.38	-	-
21	10.34	-	-
36	07.63	180	-
26	-	310	-
27 & 28	-	56 & 48	-
29 & 38	-	25 & 78	-
35 & 37	-	110 & 142	-
30 & 31	-	133 & 220	-
33 & 34	-	300 & 20	YES.
32 & 39	-	50 & 60	-
41 & 42	-	310 & 140	-
43	-	230	-
14	31.2	-	-
16	31.2	-	-
25	22.8	-	-
17	22.8	-	-
20 & 40	Reference Temperature	-	-

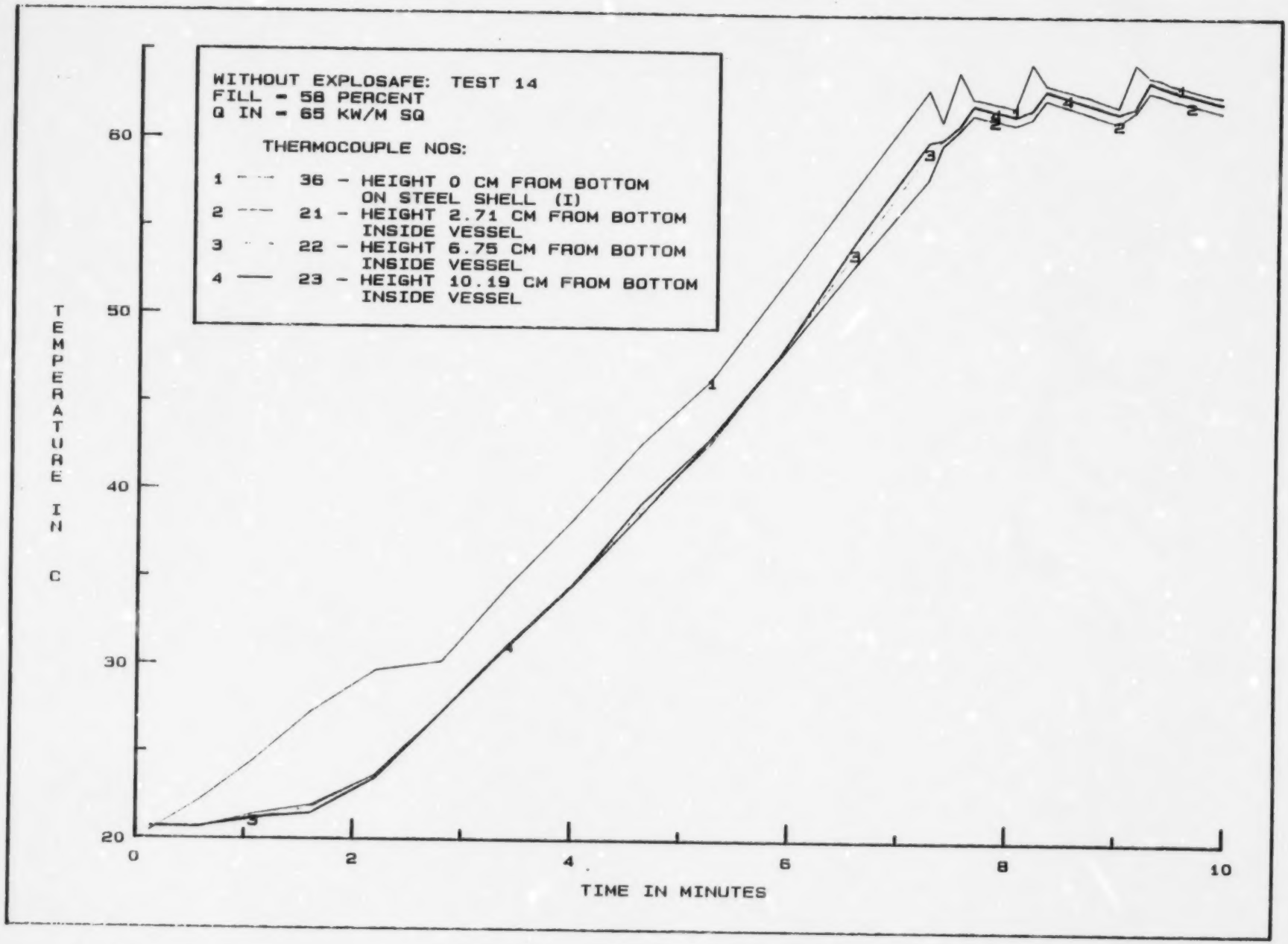
Fig. III.A A grid layout of thermocouples along with their locations for an unprotected vessel(UNB) with the PRV orifice of 1/4 in. (Valid for 76, 58 and 23 percent liquid full cases)

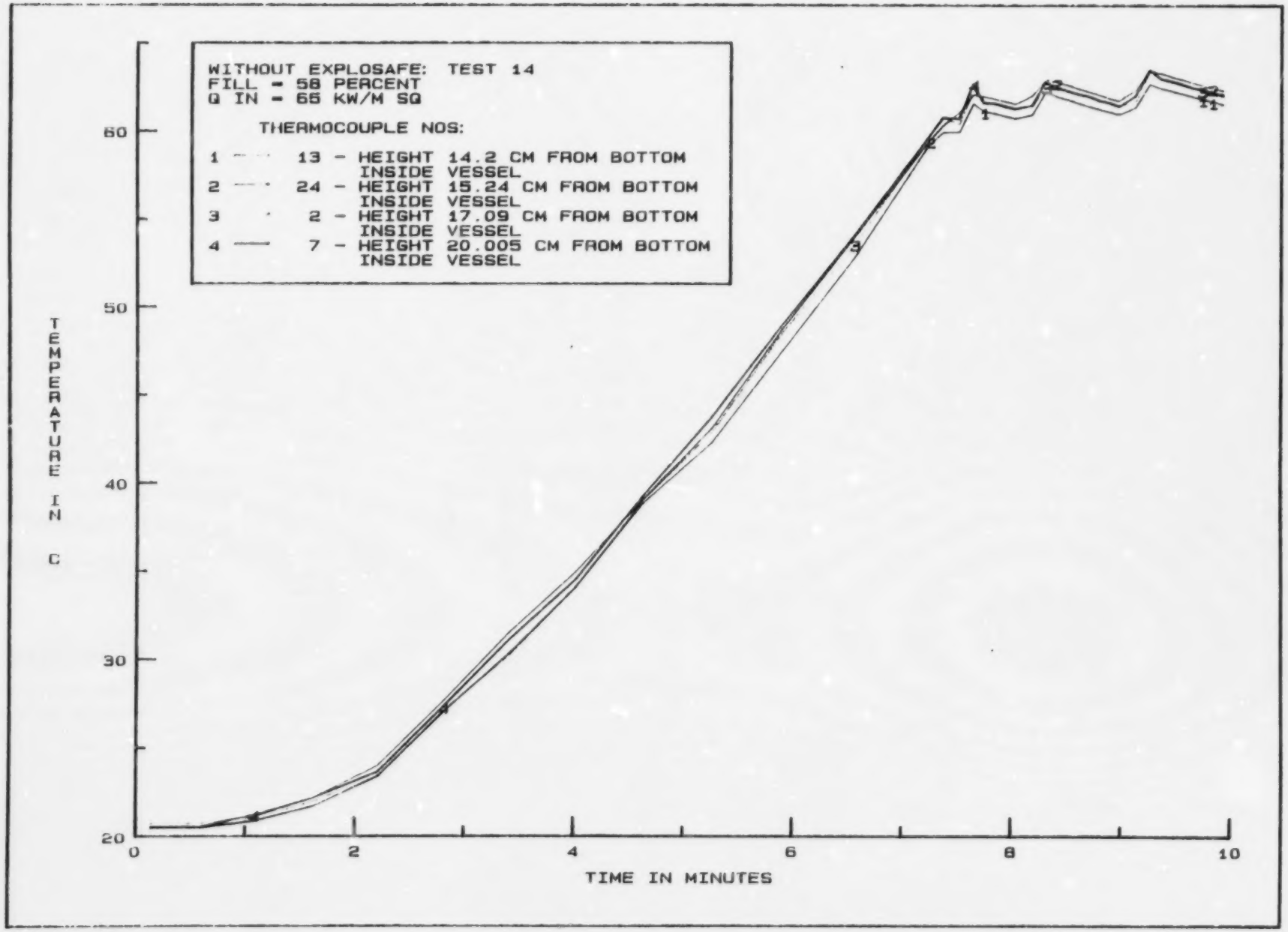
FOLLOWING THERMOCOUPLES ARE PLACED

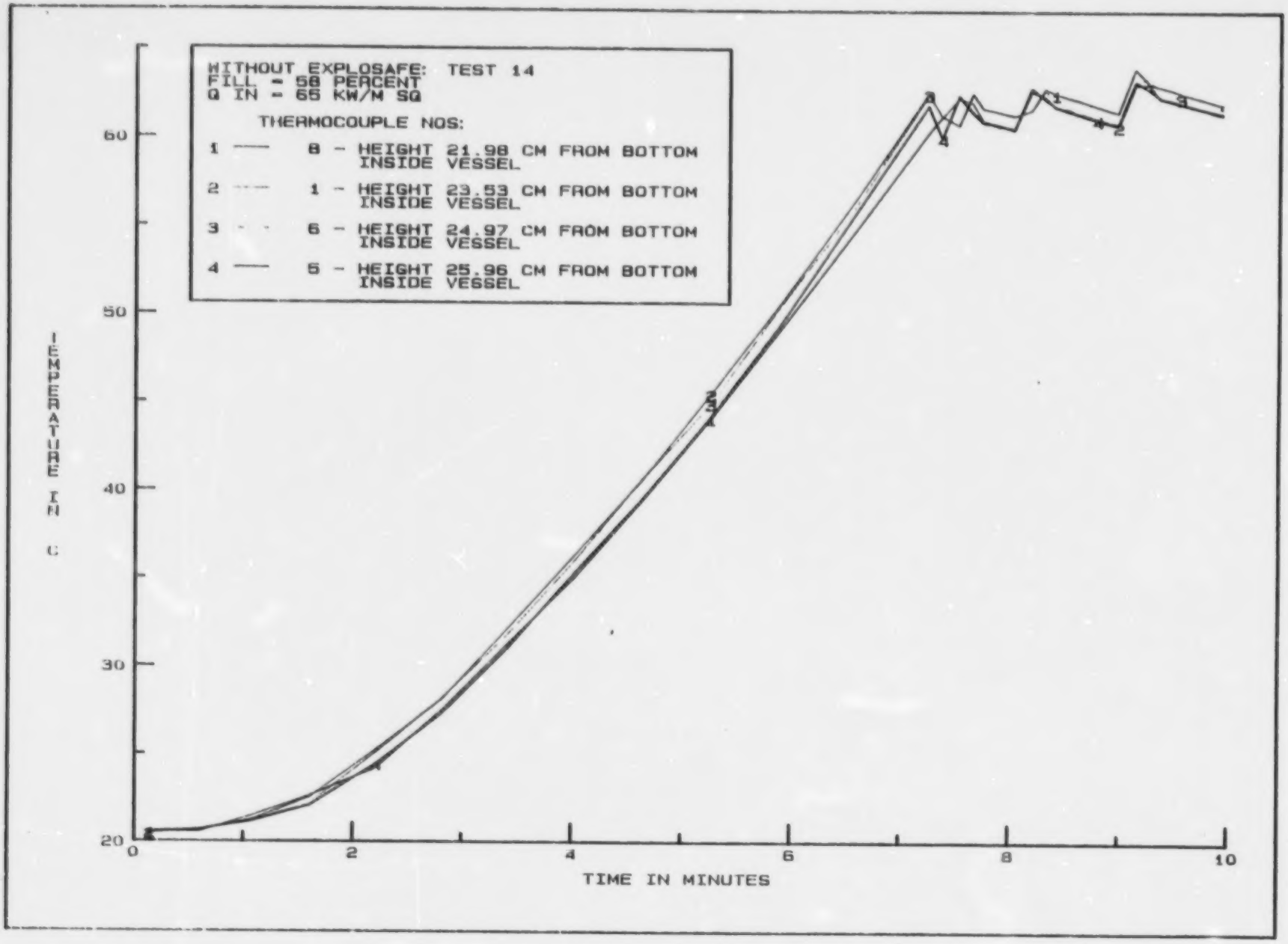
AT THE CENTRE OF THE VESSEL (DIA. 38.1 CM)

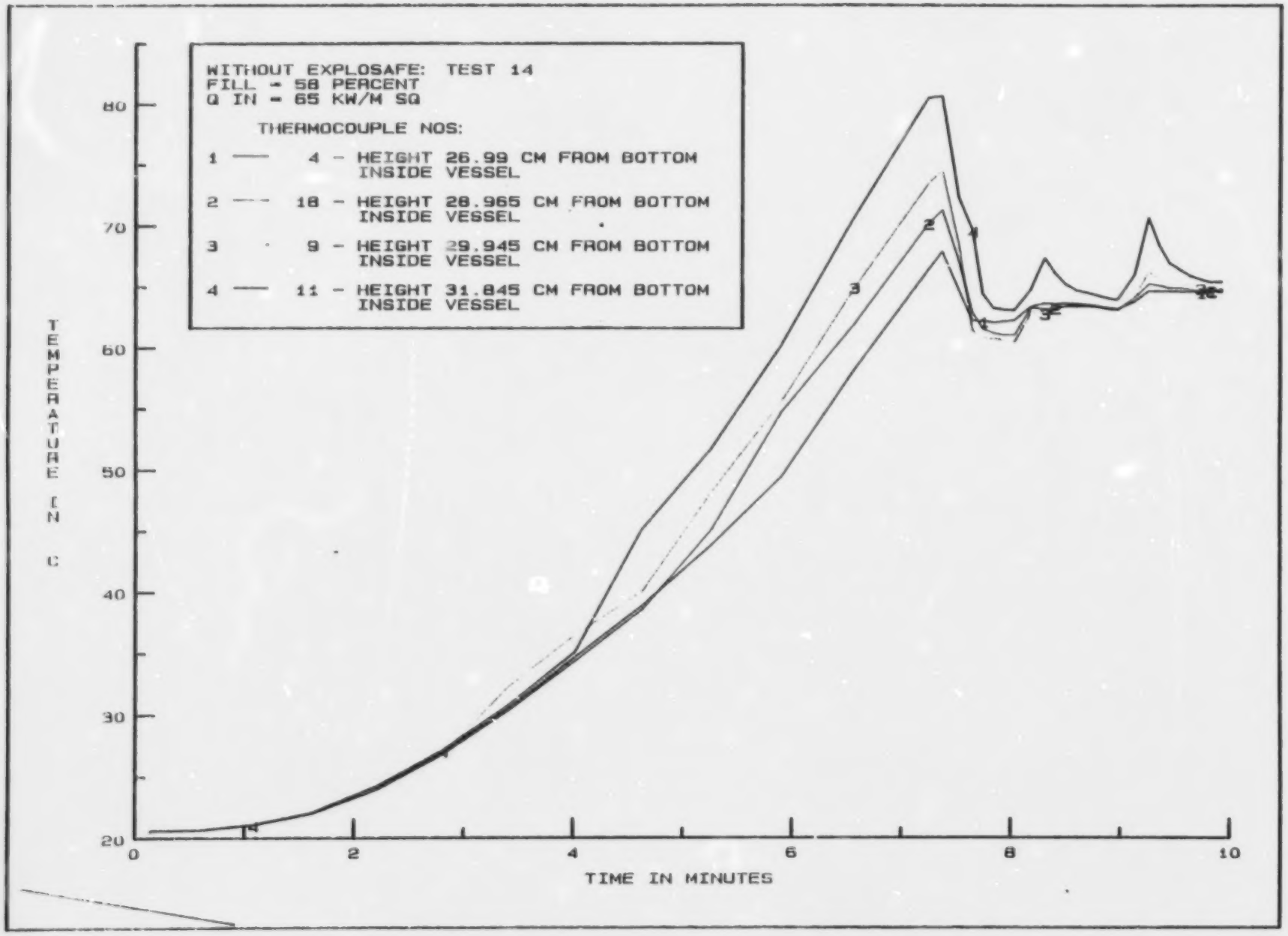
IN A VERTICLE AXIS

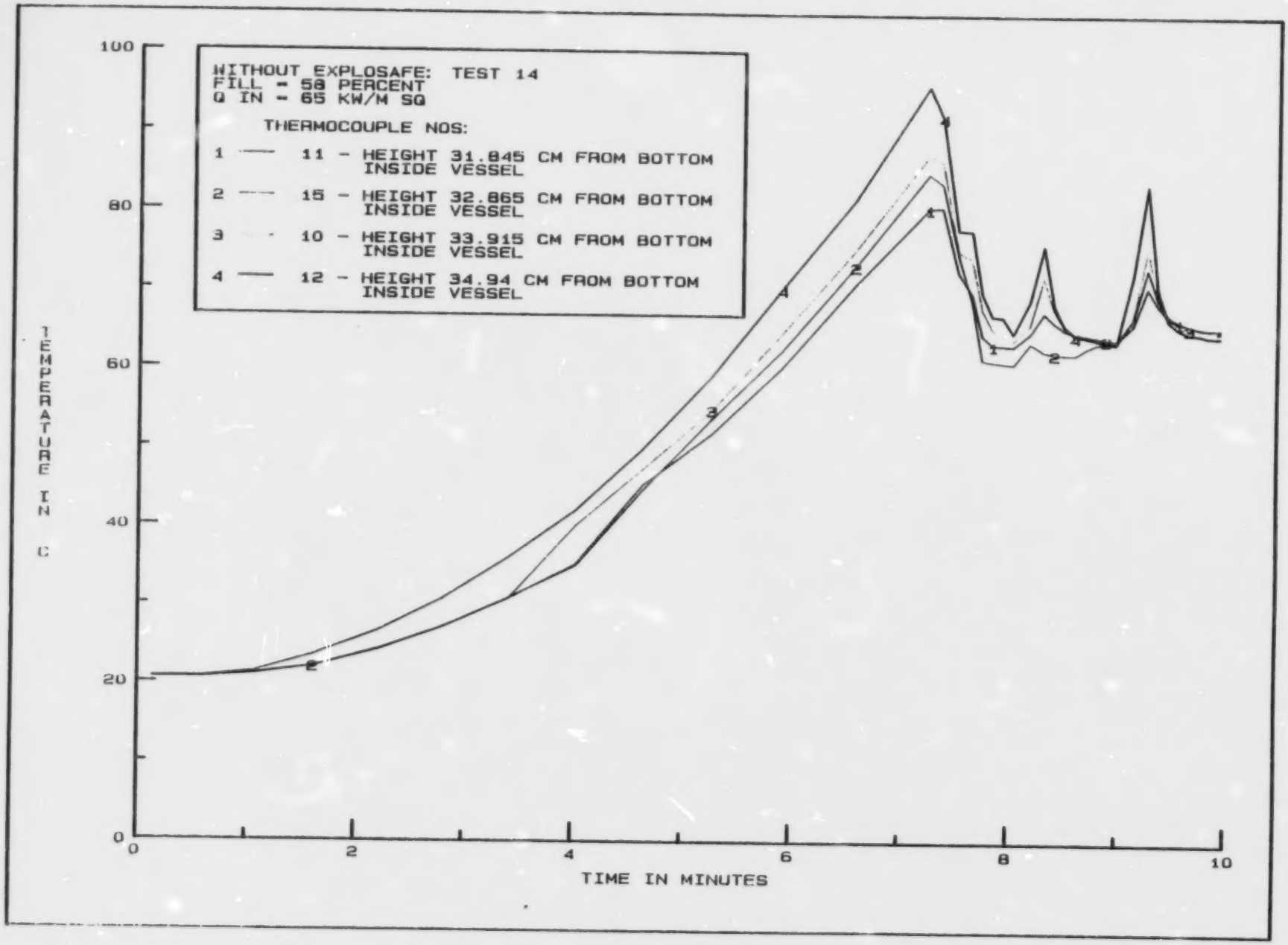
THERMOCOUPLE NUM.	HEIGHT FROM BOTTOM IN CM
38 OR I	0
21	2.71
22	6.75
23	10.19
13	14.2
24	15.24
2	17.09
7	20.005
3	21.98
1	23.53
6	24.97
5	25.96
4	26.99
15	28.965
9	29.945
11	31.845
17	32.865
10	33.915
12	34.94


WITHOUT EXPLOSAFE: TEST 14
FILL = 58 PERCENT
Q IN = 65 KW/M SQ
THERMOCOUPLE NOS:
1 - - - 36 - HEIGHT 0 CM FROM BOTTOM ON STEEL SHELL (I)
2 ---- 21 - HEIGHT 2.71 CM FROM BOTTOM INSIDE VESSEL
3 · · · 22 - HEIGHT 6.75 CM FROM BOTTOM INSIDE VESSEL
4 —— 23 - HEIGHT 10.19 CM FROM BOTTOM INSIDE VESSEL
TEMPERATURE IN C
60
50
40
30
20
0
2
4
6
8
10
TIME IN MINUTES


WITHOUT EXPLOSAFE: TEST 14
FILL = 58 PERCENT
Q IN = 65 KW/M SQ
THERMOCOUPLE NOS:
1 — 13 - HEIGHT 14.2 CM FROM BOTTOM INSIDE VESSEL
2 — · 24 - HEIGHT 15.24 CM FROM BOTTOM INSIDE VESSEL
3 · 2 - HEIGHT 17.09 CM FROM BOTTOM INSIDE VESSEL
4 — 7 - HEIGHT 20.005 CM FROM BOTTOM INSIDE VESSEL
TEMPERATURE IN C
60
50
40
30
20
0
2
4
6
8
10
TIME IN MINUTES


WITHOUT EXPLOSAFE: TEST 14
FILL - 58 PERCENT
Q IN - 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 8 - HEIGHT 21.98 CM FROM BOTTOM INSIDE VESSEL
2 —— 1 - HEIGHT 23.53 CM FROM BOTTOM INSIDE VESSEL
3 - - 6 - HEIGHT 24.97 CM FROM BOTTOM INSIDE VESSEL
4 —— 5 - HEIGHT 25.96 CM FROM BOTTOM INSIDE VESSEL
TEMPERATURE IN C
60
50
40
30
20
0
2
4
6
8
10
TIME IN MINUTES


WITHOUT EXPLOSAFE: TEST 14
FILL = 58 PERCENT
Q IN = 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 4 - HEIGHT 26.99 CM FROM BOTTOM INSIDE VESSEL
2 —— 18 - HEIGHT 28.965 CM FROM BOTTOM INSIDE VESSEL
3 · 9 - HEIGHT 29.945 CM FROM BOTTOM INSIDE VESSEL
4 —— 11 - HEIGHT 31.845 CM FROM BOTTOM INSIDE VESSEL
TEMPERATURE IN C
80
70
60
50
40
30
20
0
2
4
6
8
10
TIME IN MINUTES


WITHOUT EXPLOSAFE: TEST 14
FILL = 58 PERCENT
Q IN = 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 11 - HEIGHT 31.845 CM FROM BOTTOM INSIDE VESSEL
2 —— 15 - HEIGHT 32.865 CM FROM BOTTOM INSIDE VESSEL
3 - 10 - HEIGHT 33.915 CM FROM BOTTOM INSIDE VESSEL
4 —— 12 - HEIGHT 34.94 CM FROM BOTTOM INSIDE VESSEL
TEMPERATURE IN C
100
80
60
40
20
0
0
2
4
6
8
10
TIME IN MINUTES

FOLLOWING ARE HEIGHT VS TEMPERATURE

PLOTS FOR THE

THERMOCOUPLES PLACED AT THE CENTRE

OF THE VESSEL

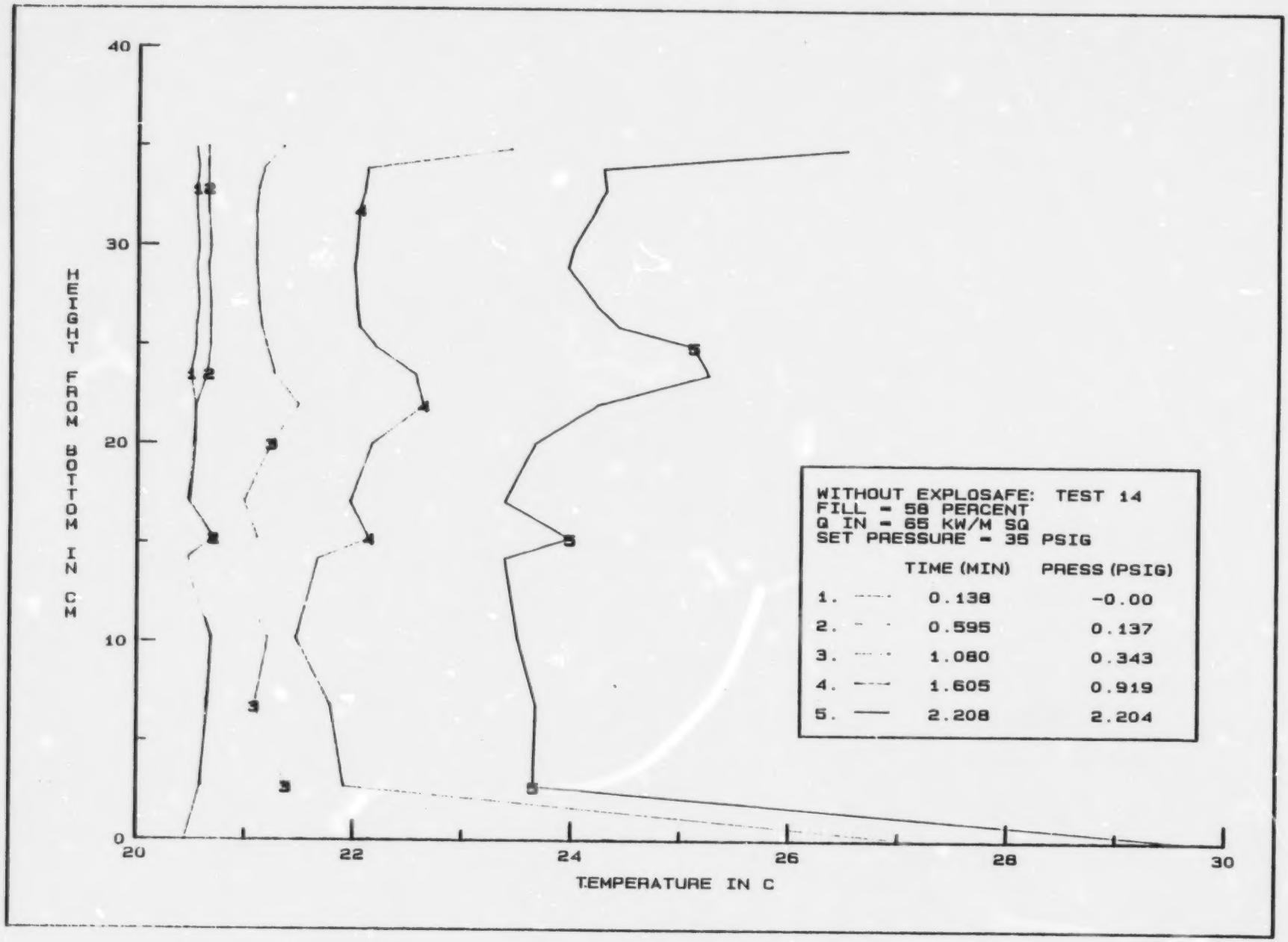
IN A VERTICAL AXIS

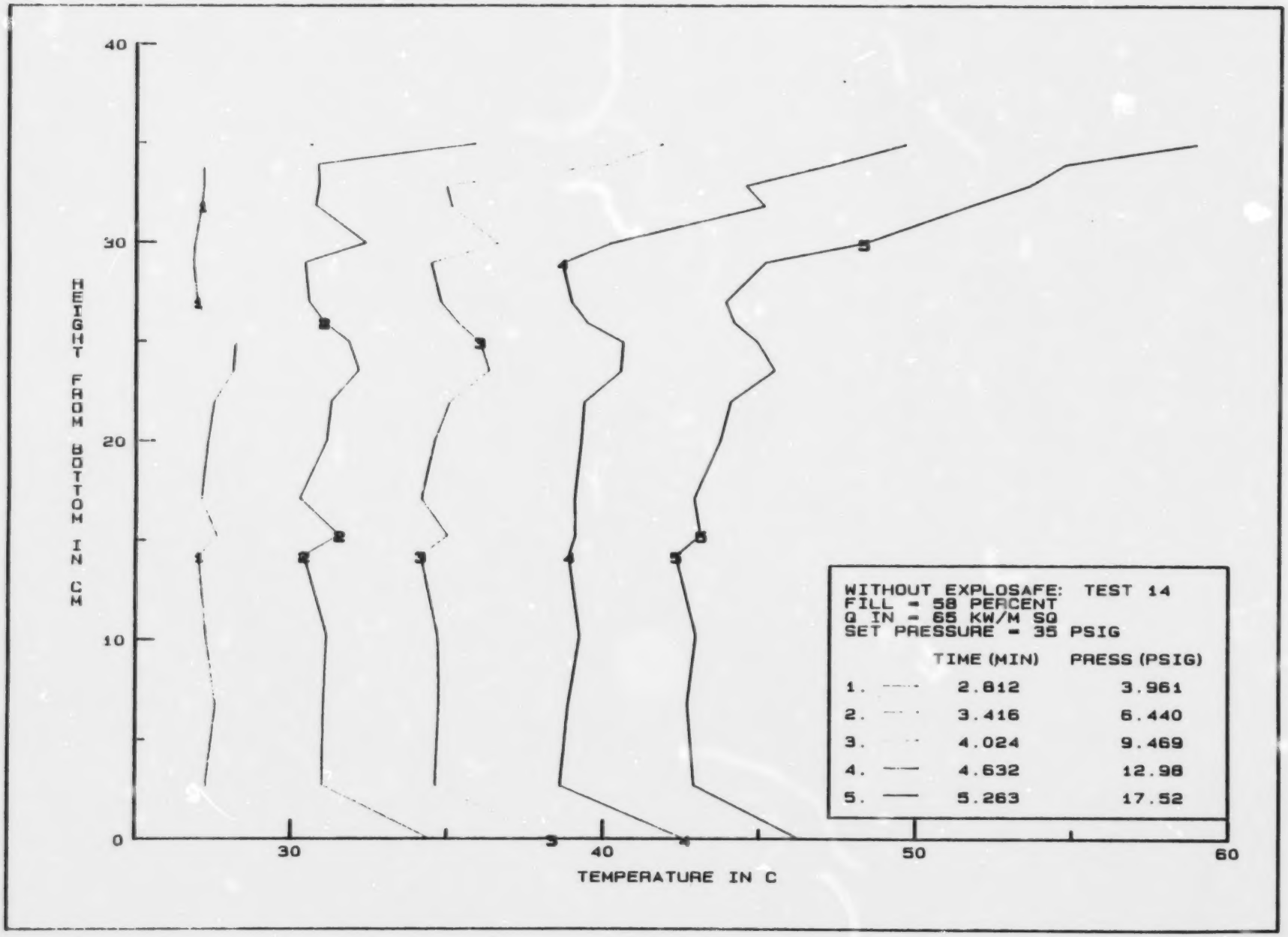
EACH PLOT REPRESENTS ONE SCAN OF

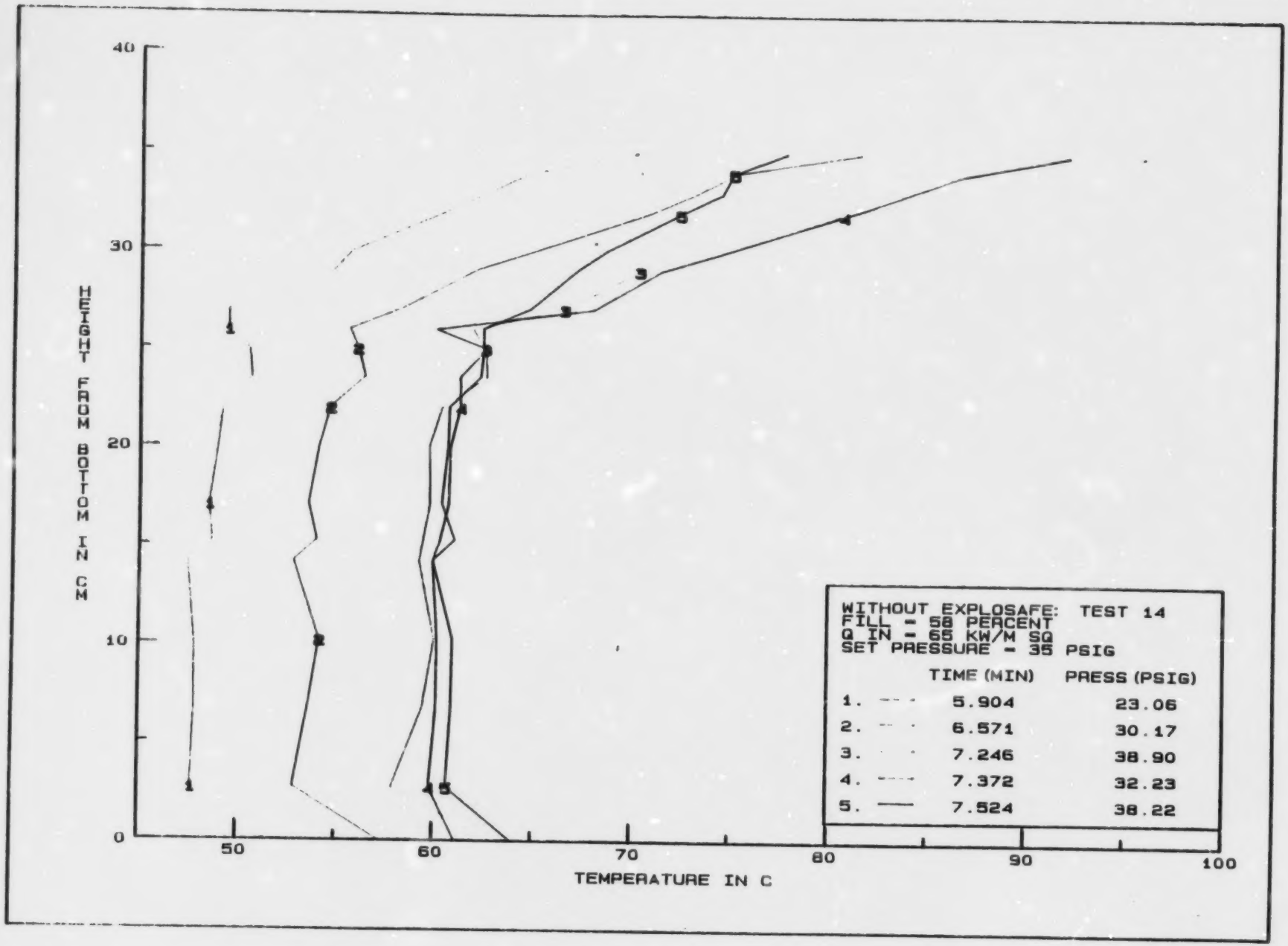
ALL THE THERMOCOUPLES

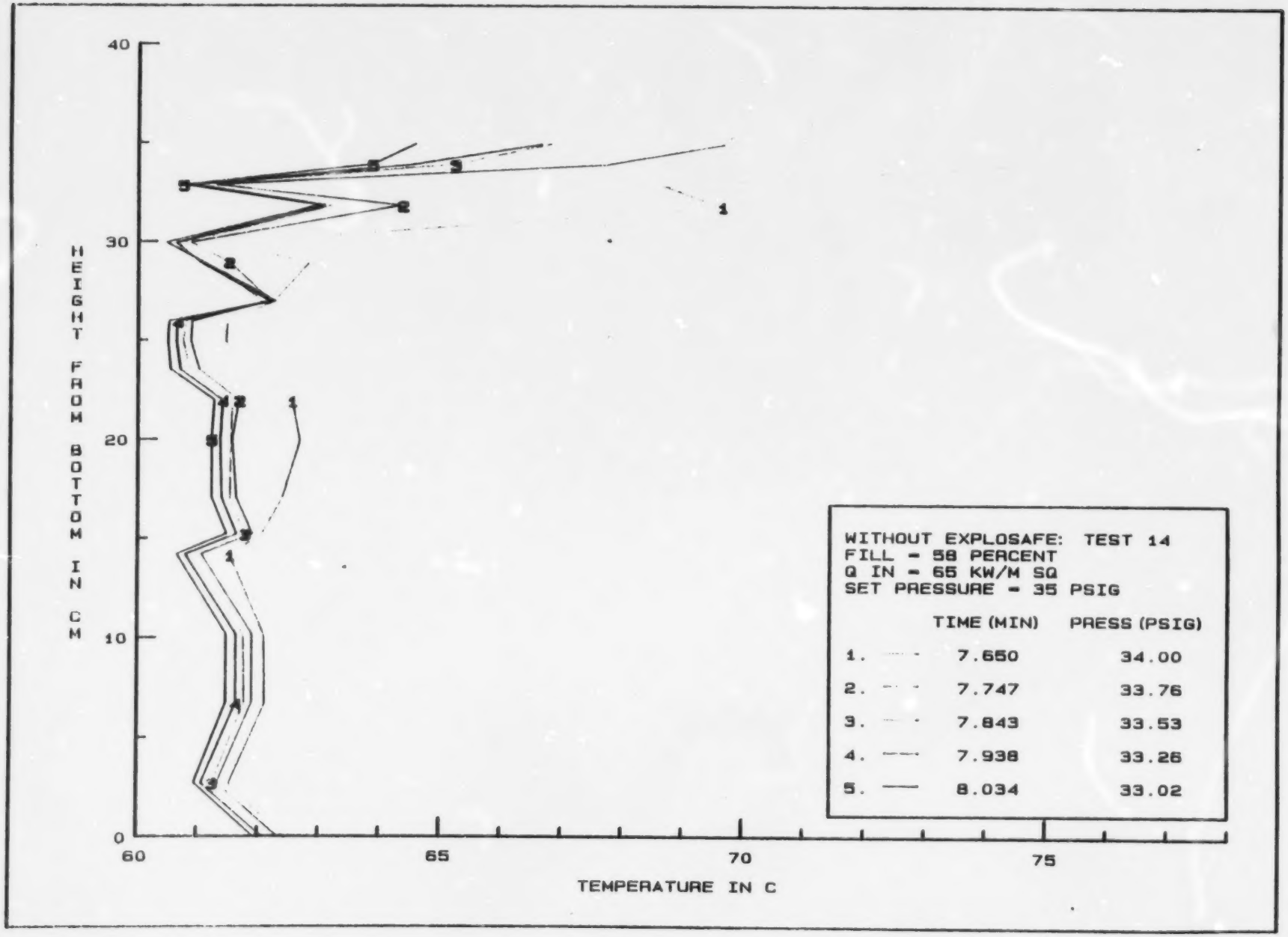
PLOTS ARE GIVEN AS FIVE (5) SCANS

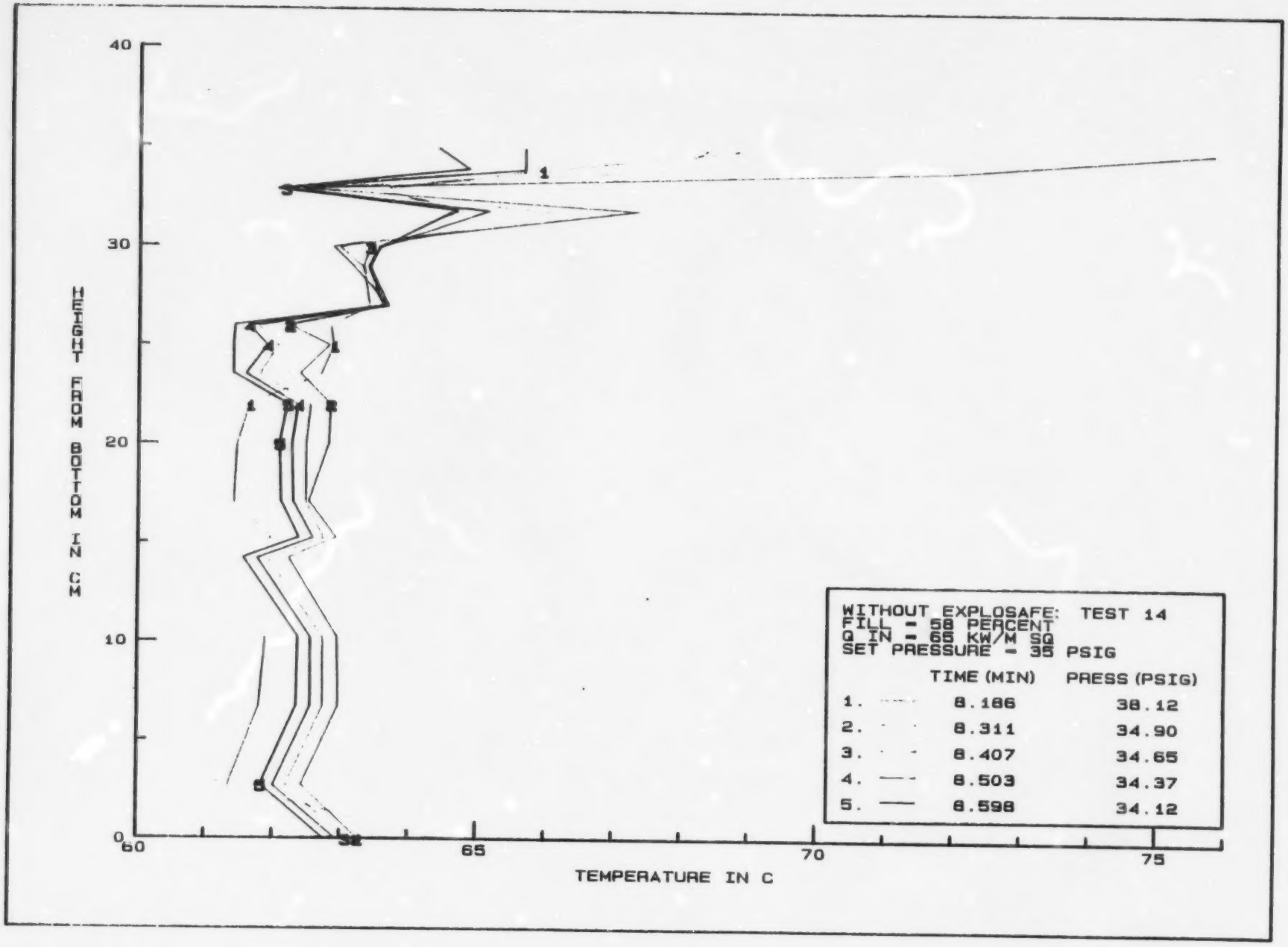
PER PAGE

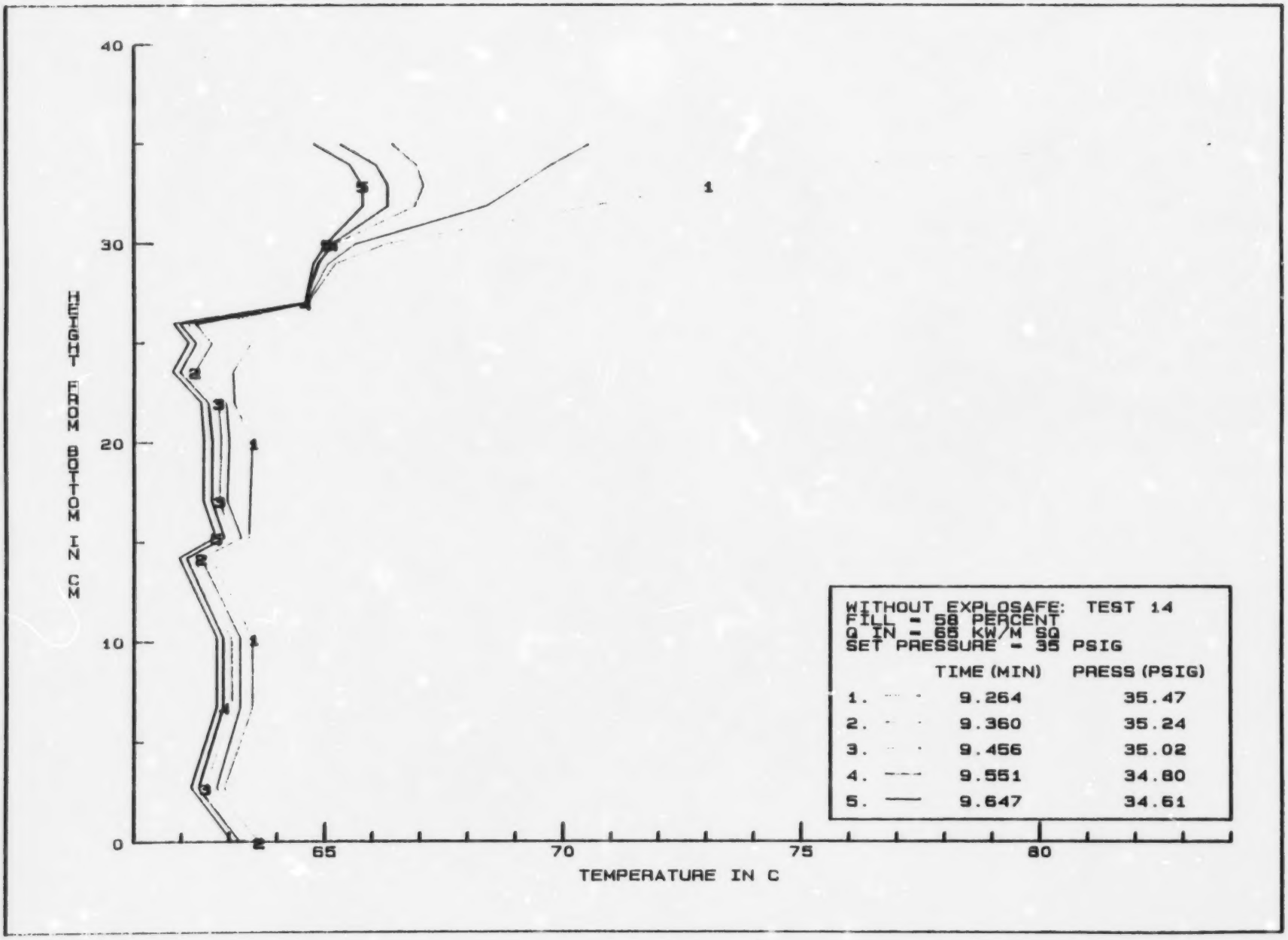

HEIGHT FROM BOTTOM IN CM
TEMPERATURE IN C
0
10
20
30
40
20
22
24
26
28
30
WITHOUT EXPLOSAFE: TEST 14
FILL - 58 PERCENT
Q IN - 65 KW/M SQ
SET PRESSURE - 35 PSIG
TIME (MIN) PRESS (PSIG)
1. 0.138 -0.00
2. 0.595 0.137
3. 1.080 0.343
4. 1.605 0.919
5. 2.208 2.204

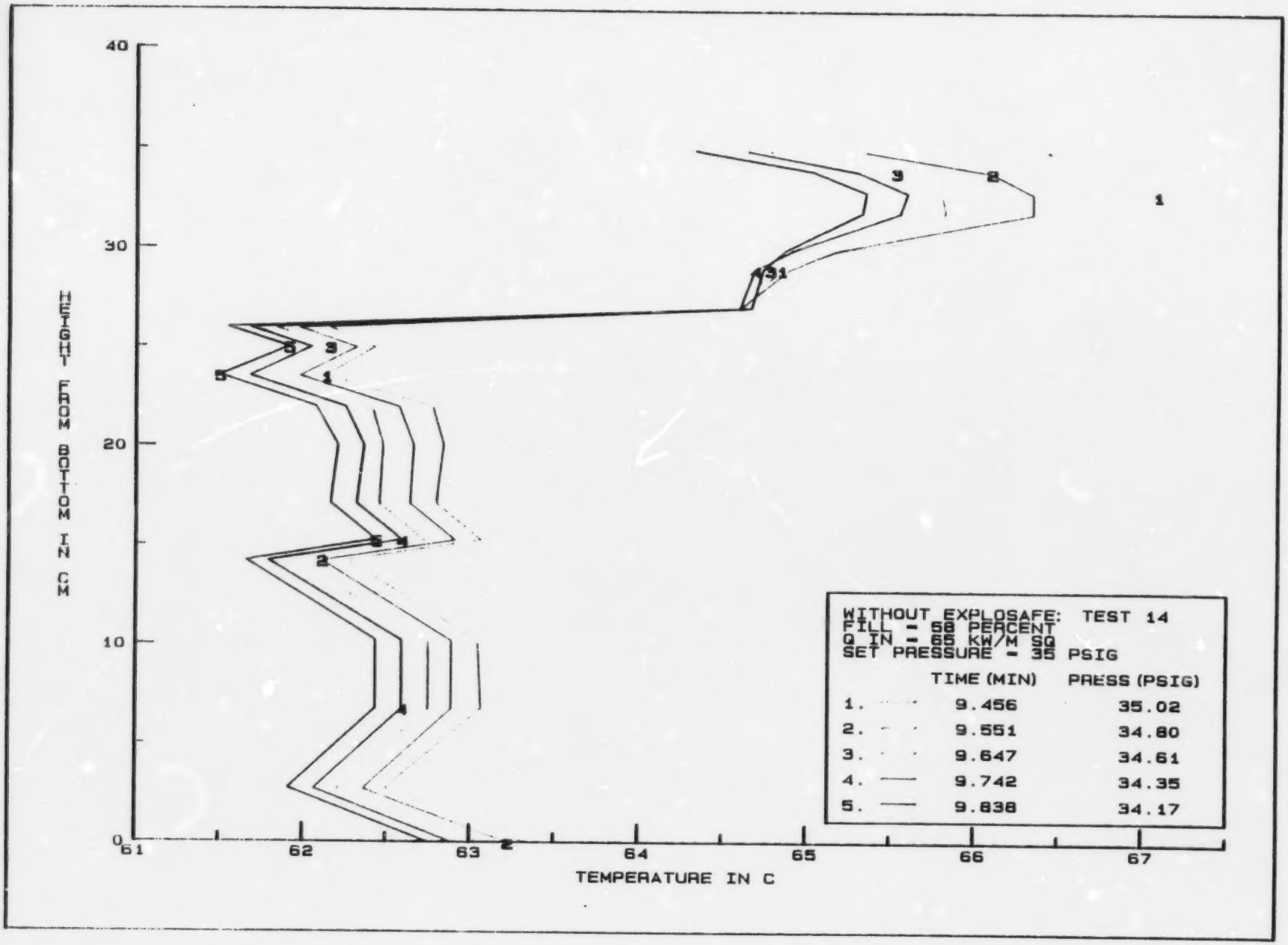

HEIGHT FROM BOTTOM IN CM
0
10
20
30
40
30
40
50
60
TEMPERATURE IN C
WITHOUT EXPLOSAFE: TEST 14
FILL = 58 PERCENT
Q IN = 65 KW/M SQ
SET PRESSURE = 35 PSIG
TIME (MIN) PRESS (PSIG)
1. 2.812 3.961
2. 3.416 6.440
3. 4.024 9.469
4. 4.632 12.98
5. 5.263 17.52


HEIGHT FROM BOTTOM IN CM
0
10
20
30
40
50
60
70
80
90
100
TEMPERATURE IN C
WITHOUT EXPLOSAFE: TEST 14
FILL = 58 PERCENT
Q IN = 65 KW/M SQ
SET PRESSURE = 35 PSIG
TIME (MIN) PRESS (PSIG)
1. 5.904 23.06
2. 6.571 30.17
3. 7.246 38.90
4. 7.372 32.23
5. 7.524 38.22


HEIGHT FROM BOTTOM IN CM
40
30
20
10
0
60
65
70
75
TEMPERATURE IN C
WITHOUT EXPLOSAFE: TEST 14
FILL - 58 PERCENT
Q IN - 65 KW/M SQ
SET PRESSURE - 35 PSIG
TIME (MIN) PRESS (PSIG)
1. 7.650 34.00
2. 7.747 33.76
3. 7.843 33.53
4. 7.938 33.26
5. 8.034 33.02

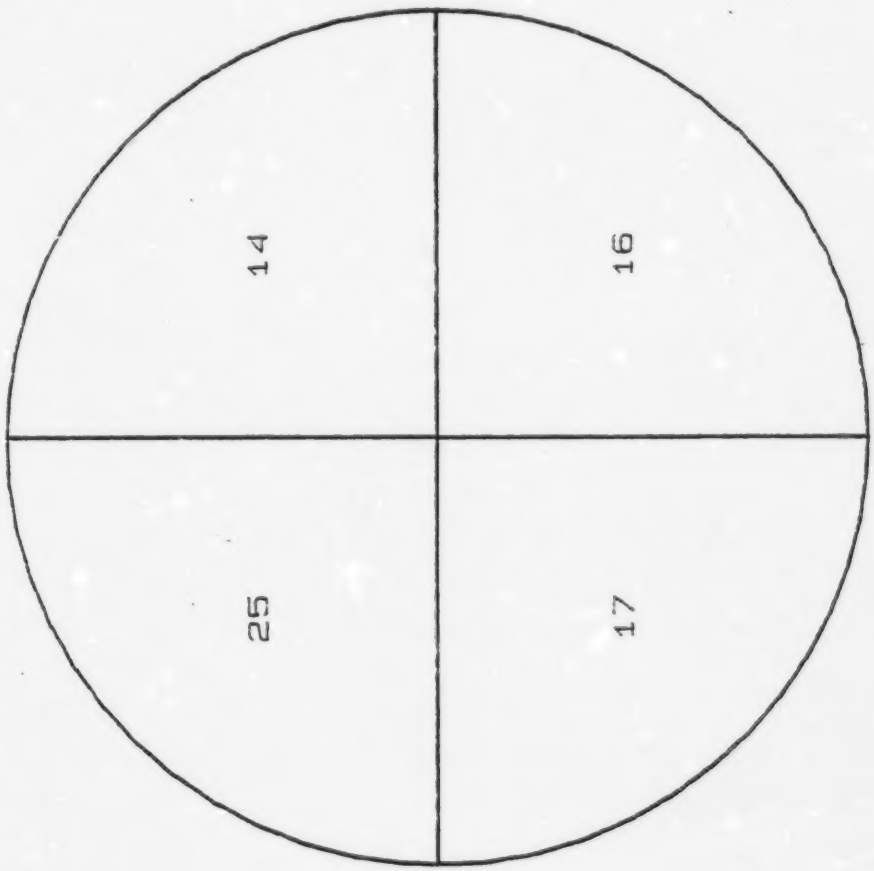

HEIGHT FROM BOTTOM IN CM
40
30
20
10
0
60
65
70
75
TEMPERATURE IN C
WITHOUT EXPLOSAFE: TEST 14
FILL - 58 PERCENT
Q IN - 65 KW/M SQ
SET PRESSURE - 35 PSIG
TIME (MIN) PRESS (PSIG)
1. 8.186 38.12
2. 8.311 34.90
3. 8.407 34.65
4. 8.503 34.37
5. 8.598 34.12


HEIGHT FROM BOTTOM IN CM
40
30
20
10
0
65
70
75
80
TEMPERATURE IN C
WITHOUT EXPLOSAFE: TEST 14
FILL = 58 PERCENT
Q IN = 65 KW/M SQ
SET PRESSURE = 35 PSIG
TIME (MIN) PRESS (PSIG)
1. 9.264 35.47
2. 9.360 35.24
3. 9.456 35.02
4. 9.551 34.80
5. 9.647 34.61


HEIGHT FROM BOTTOM IN CM
40
30
20
10
0
61
62
63
64
65
66
67
TEMPERATURE IN C
WITHOUT EXPLOSAFE: TEST 14
FILL - 68 PERCENT
Q IN - 65 KW/M SQ
SET PRESSURE - 35 PSIG
TIME (MIN) PRESS (PSIG)
1. 9.456 35.02
2. 9.551 34.80
3. 9.647 34.61
4. 9.742 34.35
5. 9.838 34.17

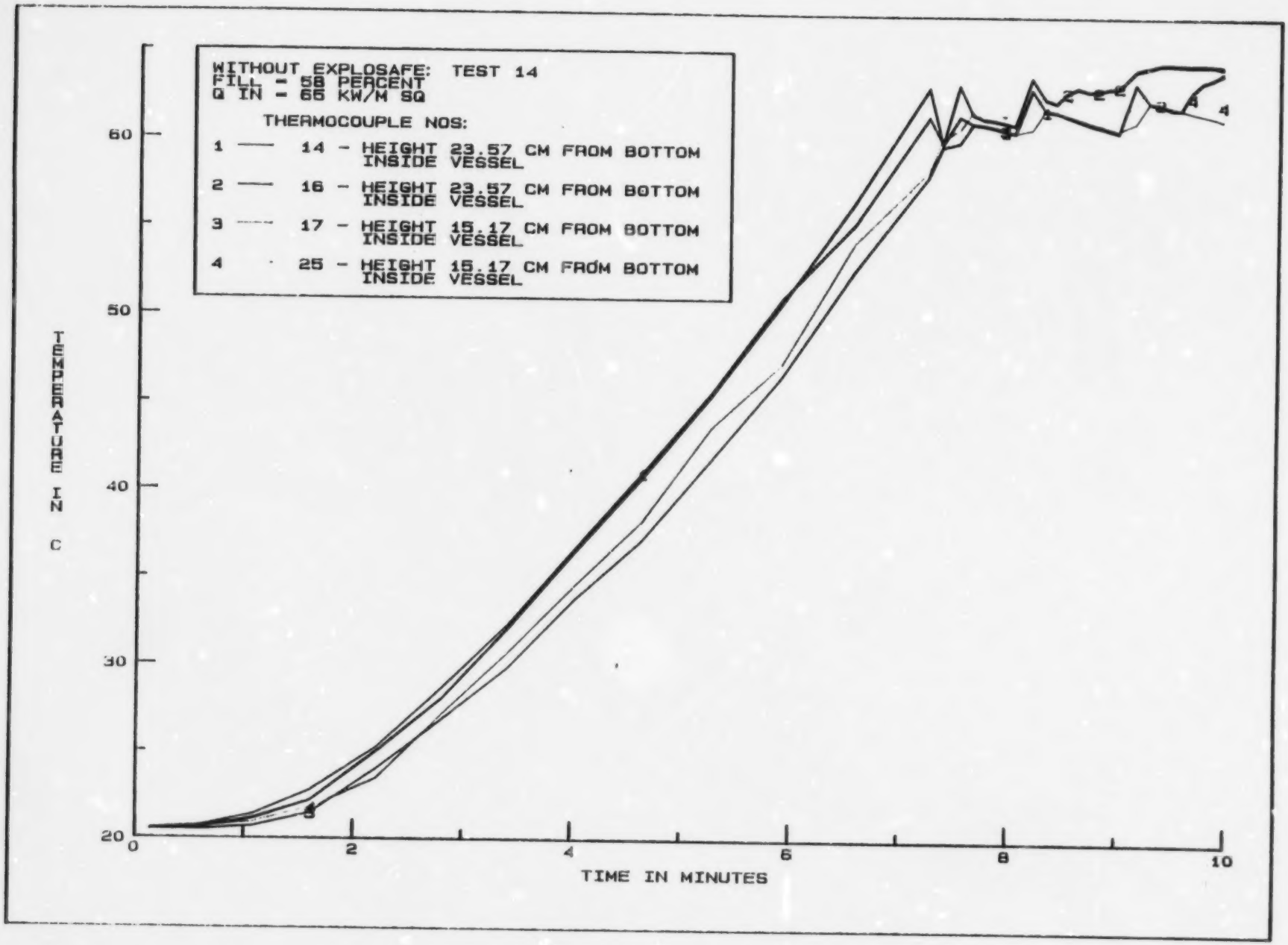
FOLLOWING FOUR THERMOCOUPLES ARE PLACED

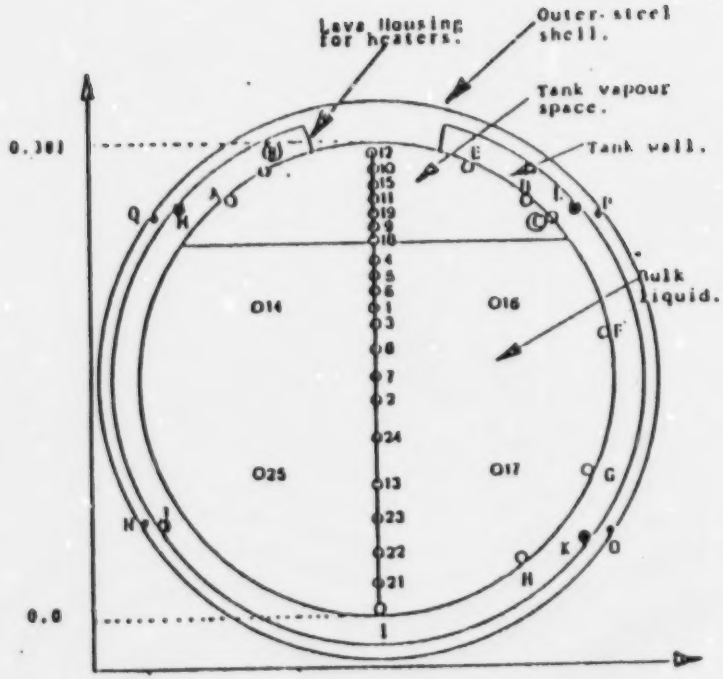
AT THE FOUR QUADRANTS ON A VERTICAL PLANE



THERMOCOUPLE NUM.	HEIGHT FROM BOTTOM IN CM
14 AND 16	23.57
25 AND 17	15.17

PLOTS ARE GIVEN TWO PER PAGE.


WITHOUT EXPLOSAFE: TEST 14
FILL - 58 PERCENT
Q IN - 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 14 - HEIGHT 23.57 CM FROM BOTTOM INSIDE VESSEL
2 —— 16 - HEIGHT 23.57 CM FROM BOTTOM INSIDE VESSEL
3 —— 17 - HEIGHT 15.17 CM FROM BOTTOM INSIDE VESSEL
4 25 - HEIGHT 15.17 CM FROM BOTTOM INSIDE VESSEL
TEMPERATURE IN C
60
50
40
30
20
0
2
4
6
8
10
TIME IN MINUTES



SYMBOL	Thermocouple #.	Angle (Deg)
A	26	310
B	34	20
C	27	56
D & E	28 & 29	48 & 35
F & G	38 & 35	78 & 110
H & I	37 & 36	142 & 180
J & K	30 & 31	133 & 220
L & M	32 & 33	50 & 300
N & O	42 & 43	140 & 230
P & Q	39 & 41	60 & 310

○ Circled thermocouples are inserted inside the vapour space wall.

Number 44 represents pressure(vessel) in psig.
Number 45 represents time in seconds.
Reference upper diameter = 45.47 cms.

Thermocouple numbers.	Height (cm)	Angle with the vertical (Deg.)	Doubtful or faulty Thermocouple.
12	42.57	-	-
10	41.545	-	-
15	40.495	-	-
11	39.475	-	-
19	38.55	-	YES.
09	37.575	-	-
18	36.595	-	-
04	34.62	-	-
05	33.59	-	-
06	32.60	-	-
01	31.16	-	-
03	30.63	-	YES.
08	29.61	-	-
07	27.635	-	-
02	24.72	-	-
24	22.87	-	-
13	21.83	-	-
23	17.82	-	-
22	14.38	-	-
21	10.34	-	-
26	07.63	180	-
26	-	310	-
27 & 28	-	56 & 48	-
29 & 38	-	25 & 78	-
35 & 37	-	110 & 142	-
30 & 31	-	133 & 220	-
33 & 34	-	300 & 20	YES.
32 & 39	-	50 & 60	-
41 & 42	-	310 & 140	-
43	-	230	-
14	31.2	-	-
16	31.2	-	-
25	22.8	-	-
17	22.8	-	-
20 & 40	Reference Temperature	-	-

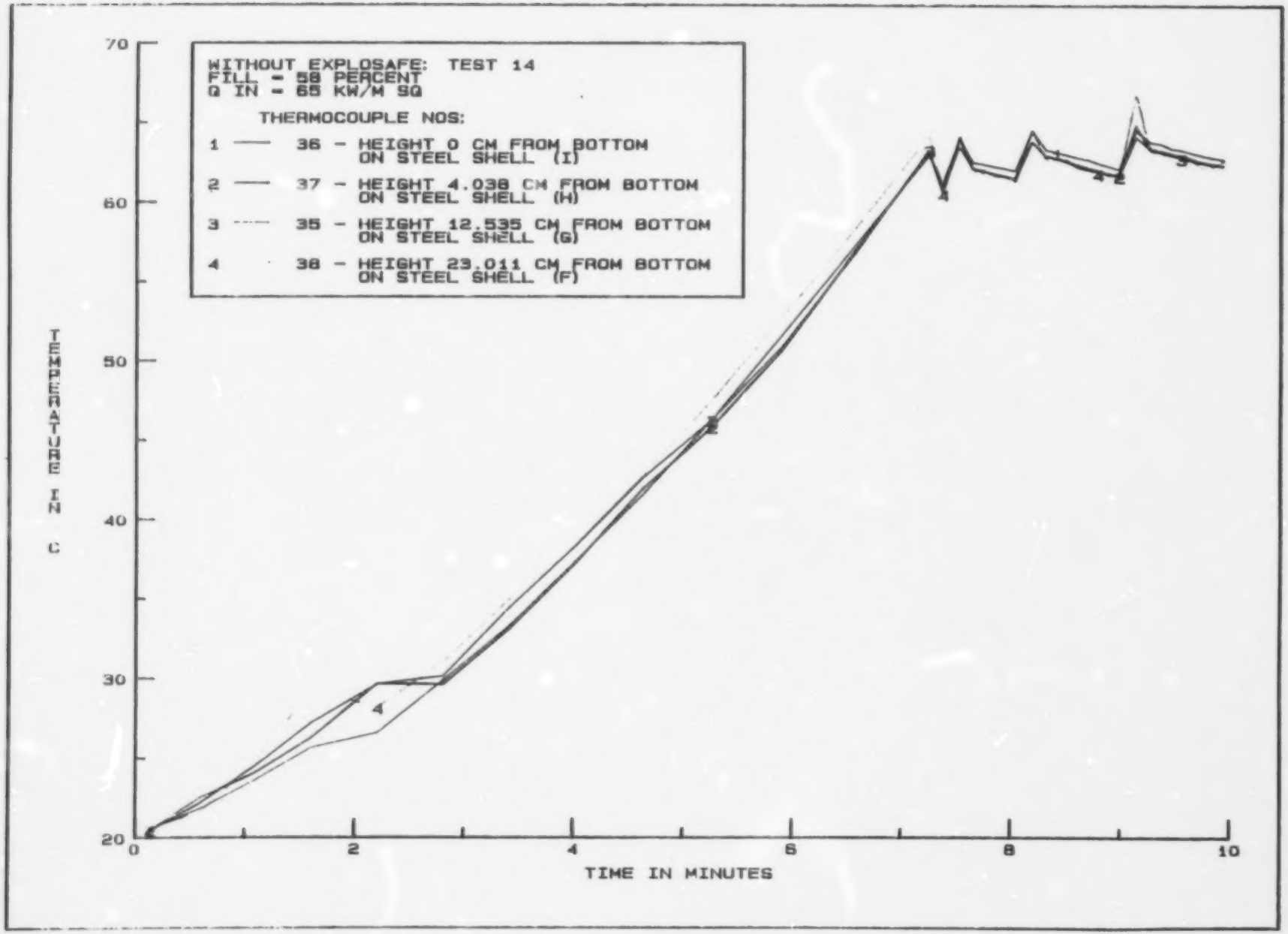
Fig. III.A A grid layout of thermocouples along with their locations for an unprotected vessel(UNB) with the PRV orifice of 1/4 in. (Valid for 76, 58 and 23 percent liquid full cases)

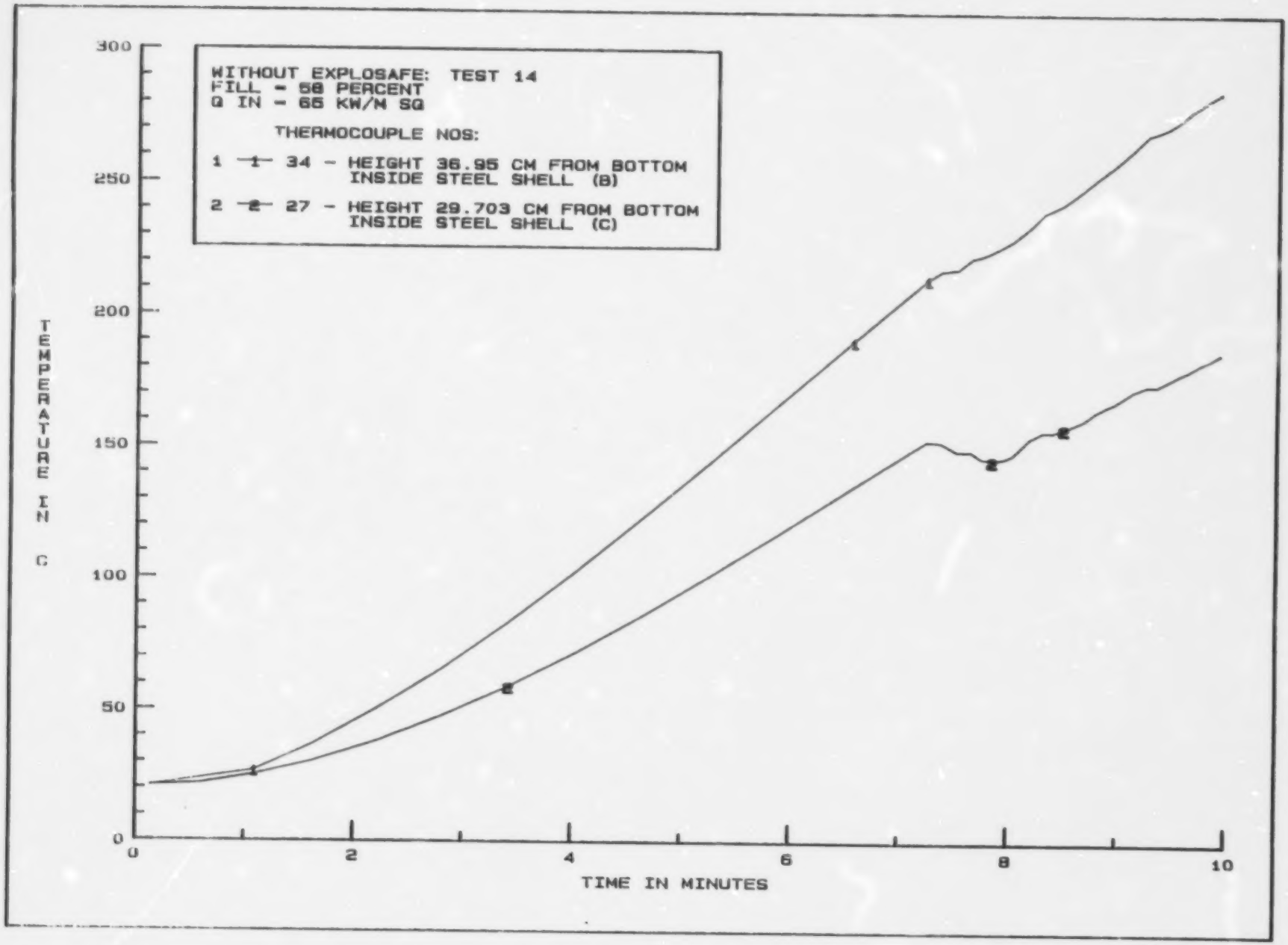
FOLLOWING THERMOCOUPLES ARE PLACED

ON THE MILD STEEL SHELL OR

INSIDE THE MILD STEEL SHELL

THERMOCOUPLE NUM.	HEIGHT FROM BOTTOM IN CM
ON THE MILD STEEL SHELL:	
36 OR I	0
37 OR H	4.038
35 OR G	12.535
38 OR F	23.011
25 OR D	31.797
26 OR A	31.295
23 OR E	36.315
INSIDE THE MILD STEEL SHELL:	
34 OR B	36.95
27 OR C	29.703


WITHOUT EXPLOSAFE: TEST 14
FILL = 58 PERCENT
Q IN = 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 36 - HEIGHT 0 CM FROM BOTTOM ON STEEL SHELL (I)
2 —— 37 - HEIGHT 4.038 CM FROM BOTTOM ON STEEL SHELL (H)
3 ---- 35 - HEIGHT 12.535 CM FROM BOTTOM ON STEEL SHELL (G)
4 38 - HEIGHT 23.011 CM FROM BOTTOM ON STEEL SHELL (F)
TEMPERATURE IN C
70
60
50
40
30
20
0
2
4
6
8
10
TIME IN MINUTES

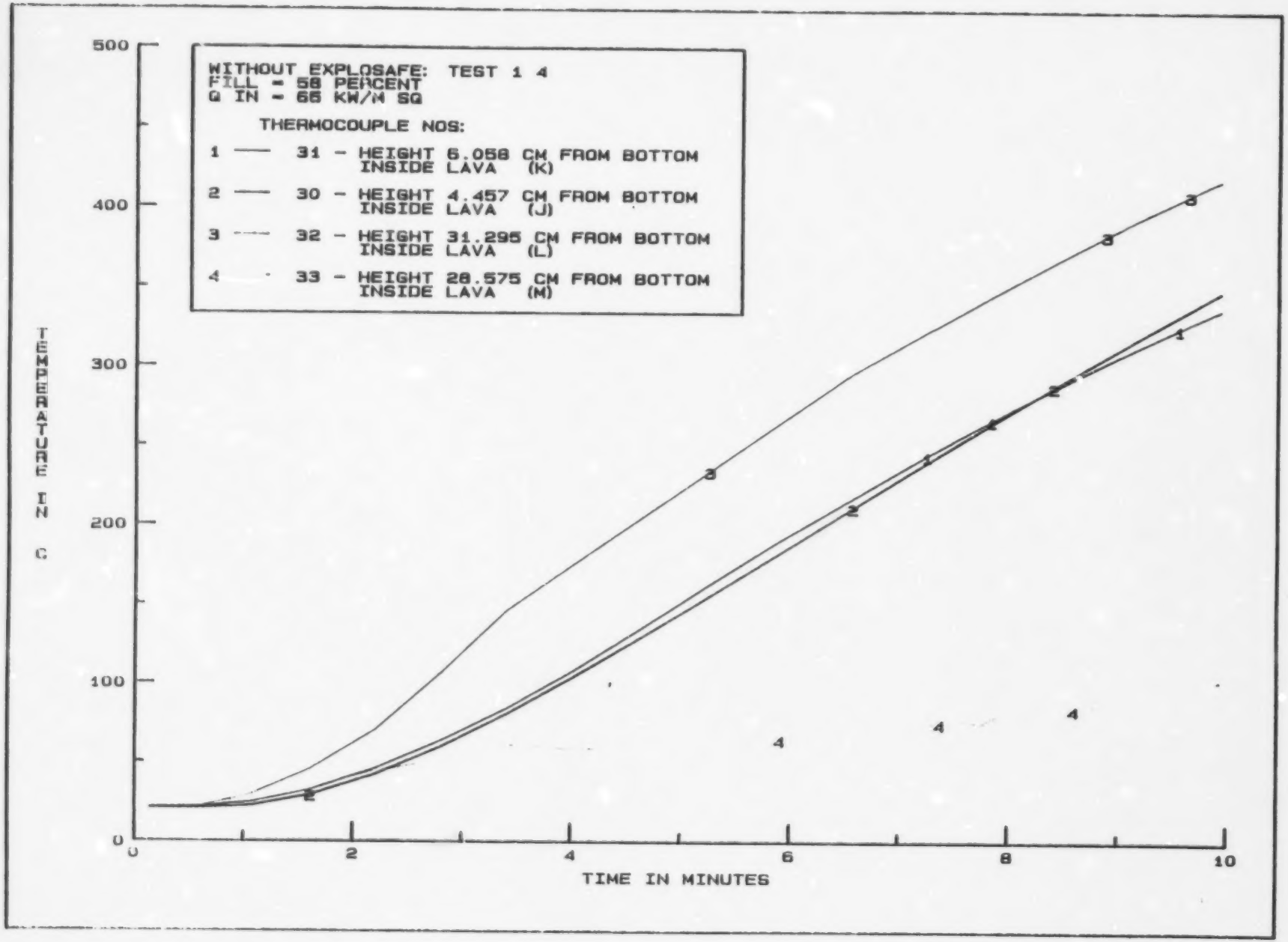

WITHOUT EXPLOSAFE: TEST 14
FILL - 58 PERCENT
Q IN - 65 KW/M SQ
THERMOCOUPLE NOS:
1 -1- 34 - HEIGHT 36.95 CM FROM BOTTOM INSIDE STEEL SHELL (B)
2 -2- 27 - HEIGHT 29.703 CM FROM BOTTOM INSIDE STEEL SHELL (C)
TEMPERATURE IN C
300
250
200
150
100
50
0
0
2
4
6
8
10
TIME IN MINUTES

FOLLOWING THERMOCOUPLES ARE PLACED

IN THE LAVA MEDIUM

THERMOCOUPLE NUM.	HEIGHT FROM BOTTOM IN CM
31 OR K	8.058
30 OR J	4.457
32 OR L	31.295
33 OR M	28.575

ALL FOUR PLOTS ARE GIVEN IN ONE PAGE

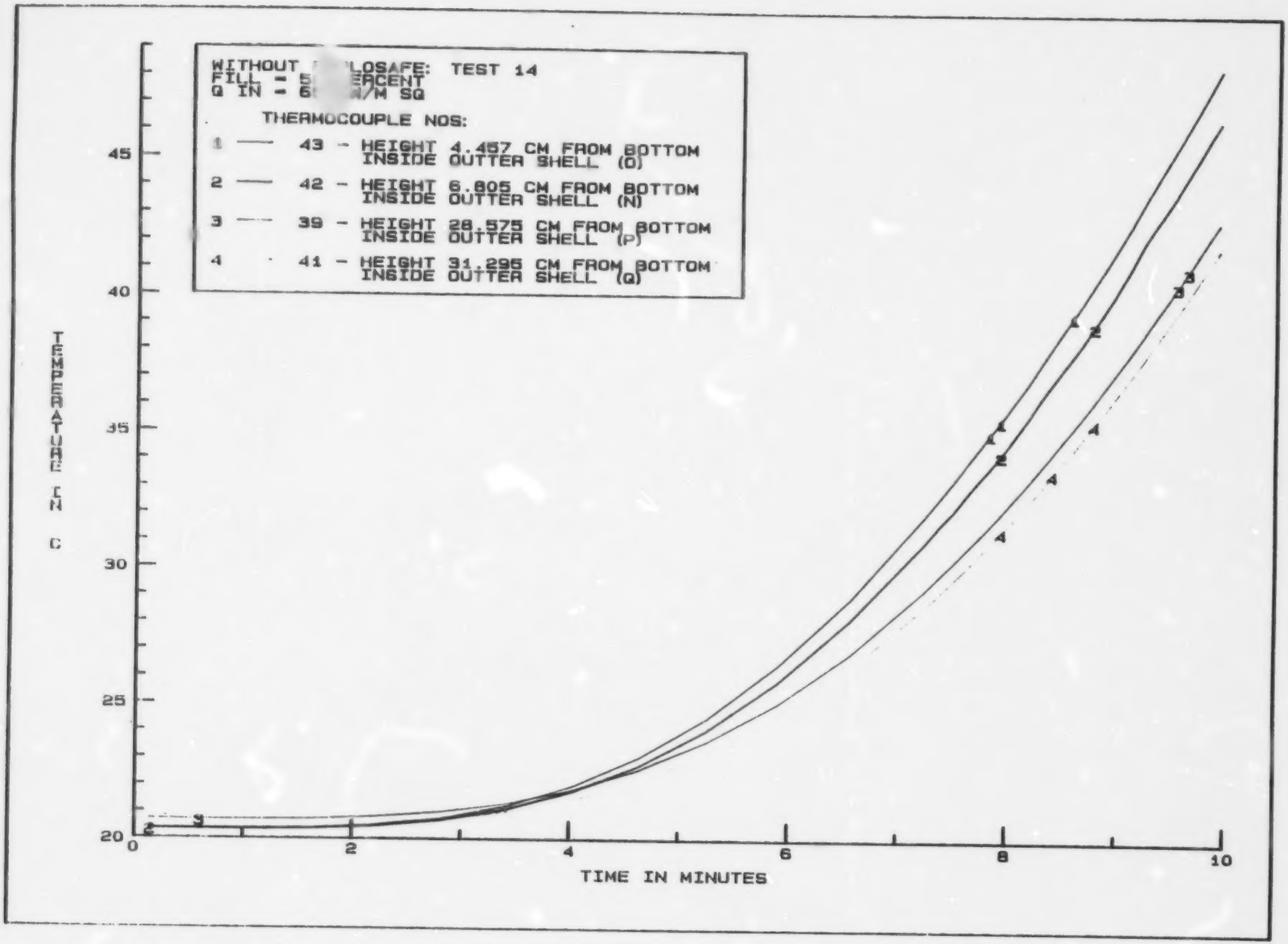

WITHOUT EXPLOSAFE: TEST 1 4
FILL = 58 PERCENT
Q IN = 66 KW/M SQ
THERMOCOUPLE NOS:
1 —— 31 - HEIGHT 6.058 CM FROM BOTTOM INSIDE LAVA (K)
2 —— 30 - HEIGHT 4.457 CM FROM BOTTOM INSIDE LAVA (J)
3 —— 32 - HEIGHT 31.295 CM FROM BOTTOM INSIDE LAVA (L)
4 —— 33 - HEIGHT 28.575 CM FROM BOTTOM INSIDE LAVA (M)
TEMPERATURE IN C
500
400
300
200
100
0
0
2
4
6
8
10
TIME IN MINUTES

FOLLOWING THERMOCOUPLES ARE PLACED

INSIDE THE OUTTER SHELL

THERMOCOUPLE NUM.	HEIGHT FROM BOTTOM IN CM
42 OR N	6.805
43 OR O	4.457
41 OR Q	31.295
39 OR P	28.575

ALL FOUR PLOTS ARE GIVEN IN ONE PAGE


WITHOUT [illegible]LOSAFE: TEST 14
FILL - 5[illegible]ERCENT
Q IN - 6[illegible]/M SQ
THERMOCOUPLE NOS:
1 —— 43 - HEIGHT 4.457 CM FROM BOTTOM INSIDE OUTTER SHELL (O)
2 —— 42 - HEIGHT 6.805 CM FROM BOTTOM INSIDE OUTTER SHELL (N)
3 —— 39 - HEIGHT 28.575 CM FROM BOTTOM INSIDE OUTTER SHELL (P)
4 —— 41 - HEIGHT 31.296 CM FROM BOTTOM INSIDE OUTTER SHELL (Q)
TEMPERATURE IN C
45
40
35
30
25
20
0
2
4
6
8
10
TIME IN MINUTES

TEST 14

WITHOUT EXPLOSAFE

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITHOUT EXPLOSAFE - FILE NAME : TEST 14

DATE OF TEST : JAN 17, 1984 Q IN = 65 KW/M SQ LIQUID LEVEL = 50 PERCENT

SET PRESSURE = 35 PSIG PRV ORIFICE DIAMETER = 1/4 INCHES

	TIME MINS	PRESSURE PSIG	THRM#1 C	THRM#2 C	THRM#3 C	THRM#4 C	THRM#5 C	THRM#6 C	THRM#7 C	THRM#8 C	THRM#9 C	THRM#10 C	THRM#11 C
1.	0.139	-0.004	20.483	20.483	*******	20.558	20.533	20.533	20.533	20.533	20.558	20.558	20.533
2.	0.598	0.137	20.645	20.472	*******	20.670	20.670	20.670	20.521	20.546	20.670	20.645	20.645
3.	1.080	0.344	21.251	20.979	*******	21.103	21.128	21.177	21.227	21.474	21.078	21.152	21.078
4.	1.605	0.919	22.550	21.957	*******	22.006	22.031	22.179	22.155	22.624	22.006	22.105	22.031
5.	2.208	2.204	25.249	23.378	*******	24.216	24.413	25.102	23.649	24.216	23.994	24.265	24.191
6.	2.813	3.962	28.129	27.102	*******	26.955	27.273	28.202	27.322	27.518	26.882	27.175	27.102
7.	3.416	6.441	32.154	30.260	*******	30.528	31.014	31.814	31.135	31.281	32.372	30.820	30.747
8.	4.024	9.470	36.313	34.147	*******	34.750	35.304	36.001	34.581	35.063	36.602	40.046	35.087
9.	4.633	12.980	40.535	39.056	*******	38.937	39.438	40.606	39.271	39.367	40.154	47.228	45.133
10.	5.264	17.526	45.472	42.896	*******	43.890	44.150	44.906	43.748	44.080	48.293	54.744	51.704
11.	5.904	23.069	50.665	48.514	*******	49.474	49.451	50.525	48.959	49.193	55.680	64.612	60.165
12.	6.571	30.171	56.406	53.560	*******	56.248	55.598	56.613	54.094	54.649	65.008	75.149	70.697
13.	7.247	38.907	62.562	59.750	*******	66.446	61.832	62.493	59.681	60.323	73.575	87.328	80.481
14.	7.372	32.234	61.217	60.714	*******	67.940	60.004	62.586	60.782	61.263	74.626	86.457	80.593
15.	7.524	38.223	62.291	60.349	*******	64.749	62.382	62.428	60.669	60.715	68.550	75.006	72.302
16.	7.650	34.004	61.996	62.384	*******	62.224	61.471	61.448	62.680	62.544	61.425	74.160	69.633
17.	7.747	33.763	61.016	61.633	*******	62.203	60.901	60.879	61.564	61.678	60.879	67.741	64.366
18.	7.843	33.531	60.857	61.519	*******	62.045	60.788	60.742	61.542	61.565	60.765	65.230	63.207
19.	7.939	33.265	60.697	61.383	*******	62.182	60.652	60.629	61.360	61.406	60.629	64.527	63.072
20.	8.034	33.024	60.538	61.224	*******	62.275	60.515	60.492	61.224	61.270	60.469	63.869	63.004
21.	8.186	38.120	62.687	61.409	*******	63.393	62.824	62.869	61.455	61.637	62.960	65.914	64.767
22.	8.312	34.902	62.370	62.506	*******	63.668	62.210	62.803	62.803	62.826	62.848	71.976	67.341
23.	8.408	34.653	61.777	62.462	*******	63.601	61.754	62.051	62.462	62.530	63.396	67.771	66.053
24.	8.503	34.378	61.573	62.280	*******	63.670	61.618	61.892	62.257	62.349	63.533	65.668	65.147
25.	8.599	34.120	61.391	62.099	*******	63.603	61.414	61.391	62.076	62.190	63.557	64.853	64.671
26.	8.694	33.875	61.209	61.917	*******	63.490	61.255	61.506	61.963	61.985	63.603	64.604	64.467
27.	8.790	33.613	61.028	61.736	*******	63.378	61.074	61.348	61.736	61.805	63.583	64.287	64.242
28.	8.885	33.385	60.869	61.577	*******	63.219	60.892	60.892	61.600	61.623	63.424	64.038	64.016
29.	8.981	33.158	60.710	61.373	*******	63.130	60.756	60.962	61.373	61.465	63.335	63.813	63.881
30.	9.136	38.640	63.063	61.649	*******	63.814	63.222	63.245	62.014	63.973	64.223	65.898	65.948
31.	9.265	35.478	63.088	63.452	*******	64.657	62.746	63.475	63.498	63.111	66.313	75.673	70.642
32.	9.360	35.246	62.269	62.952	*******	64.613	62.291	62.633	62.998	62.930	65.634	69.744	68.392
33.	9.456	35.022	62.132	62.793	*******	64.613	62.154	62.428	62.839	62.770	65.203	66.925	66.902
34.	9.552	34.803	61.974	62.635	*******	64.592	61.974	62.316	62.658	62.567	65.160	66.089	66.338
35.	9.647	34.614	61.814	62.453	*******	64.592	61.837	62.156	62.476	62.407	65.046	65.522	65.817
36.	9.743	34.356	61.679	62.318	*******	64.594	61.679	62.044	62.363	62.249	64.912	65.298	65.547
37.	9.838	34.176	61.499	62.161	*******	64.665	61.545	61.910	62.207	62.070	64.869	65.028	65.323
38.	9.934	33.978	61.362	62.001	*******	64.551	61.385	61.750	62.047	61.910	64.846	65.005	65.391
39.	10.030	33.806	61.226	61.865	*******	64.507	61.248	61.637	61.888	61.820	64.825	64.779	65.210
40.	10.125	33.643	61.112	61.729	*******	64.485	61.135	62.003	61.775	61.706	64.780	64.780	65.166

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITHOUT EXPLOSAFE - FILE NAME : TEST 14

DATE OF TEST : JAN 17, 1984 Q IN = 65 KW/M SQ LIQUID LEVEL = 50 PERCENT

SET PRESSURE = 35 PSIG PRV ORIFICE DIAMETER = 1/4 INCHES

	TIME MINS	PRESSURE PSIG	THRM#12 C	THRM#13 C	THRM#14 C	THRM#15 C	THRM#16 C	THRM#17 C	THRM#18 C	THRM#19 C	THRM#20 C	THRM#21 C	THRM#22 C
1.	0.139	-0.004	20.533	20.434	20.508	20.533	20.508	20.458	20.533	809.900	2.456	20.583	20.657
2.	0.596	0.137	20.645	20.472	20.745	20.645	20.645	20.472	20.645	815.420	2.457	20.596	20.645
3.	1.080	0.344	21.326	20.855	21.400	21.103	21.152	20.681	21.078	831.870	2.458	21.375	21.078
4.	1.605	0.919	23.414	21.660	22.797	22.080	22.204	21.462	21.982	872.360	2.460	21.907	21.784
5.	2.208	2.204	26.501	23.378	25.249	24.290	25.004	23.994	23.945	962.890	2.461	23.649	23.674
6.	2.813	3.962	30.639	27.004	28.591	27.175	28.080	26.857	26.833	*******	2.462	27.249	27.557
7.	3.416	6.441	35.846	30.382	32.323	30.868	32.081	29.822	30.406	*******	2.463	30.990	31.038
8.	4.024	9.470	41.830	34.123	36.674	34.918	36.482	33.737	34.436	*******	2.465	34.605	34.726
9.	4.633	12.980	49.618	38.865	40.987	44.518	40.702	37.118	38.626	*******	2.466	38.602	38.865
10.	5.264	17.526	58.939	42.303	45.637	53.632	45.449	41.757	45.166	*******	2.467	42.896	42.683
11.	5.904	23.069	70.081	47.459	51.039	62.359	50.759	46.543	54.778	*******	2.468	47.670	47.858
12.	6.571	30.171	81.398	52.818	58.343	73.095	56.590	52.655	62.027	*******	2.469	52.841	53.607
13.	7.247	38.907	95.801	59.200	61.512	84.879	63.177	58.097	70.258	*******	2.470	57.867	59.429
14.	7.372	32.234	91.982	59.089	60.004	83.521	59.981	59.798	71.338	*******	2.470	59.798	60.141
15.	7.524	38.223	77.674	59.913	61.538	74.448	63.316	60.028	67.105	*******	2.470	60.669	60.921
16.	7.650	34.004	77.498	61.517	61.105	68.664	61.654	61.151	62.817	*******	2.471	61.517	62.110
17.	7.747	33.763	69.680	61.061	61.039	61.290	61.404	61.039	61.496	*******	2.471	61.336	61.907
18.	7.843	33.531	66.793	60.948	60.902	61.017	61.337	60.925	61.177	*******	2.471	61.245	61.771
19.	7.939	33.265	66.636	60.789	60.743	60.880	61.201	60.812	61.018	*******	2.471	61.063	61.635
20.	8.034	33.024	64.574	60.653	60.630	60.744	61.064	60.653	61.064	*******	2.471	60.950	61.476
21.	8.186	38.120	68.806	60.883	63.097	63.530	63.757	60.883	63.302	*******	2.471	61.340	61.797
22.	8.312	34.902	75.795	62.210	61.890	62.392	62.552	62.073	63.144	*******	2.472	62.415	62.962
23.	8.408	34.653	68.335	61.914	61.823	62.142	62.348	61.891	63.282	*******	2.472	62.188	62.735
24.	8.503	34.378	65.668	61.755	61.595	62.029	62.964	61.710	63.397	*******	2.472	62.006	62.554
25.	8.599	34.120	64.398	61.551	61.391	62.030	63.238	61.528	63.375	*******	2.472	61.825	62.350
26.	8.694	33.875	64.195	61.369	61.186	62.875	63.034	61.346	63.376	*******	2.472	61.643	62.191
27.	8.790	33.613	63.901	61.211	61.028	63.446	63.036	61.188	63.309	*******	2.472	61.439	62.010
28.	8.885	33.385	63.606	61.052	60.869	63.674	63.219	61.006	63.128	*******	2.472	61.257	61.806
29.	8.981	33.158	63.358	60.893	60.710	63.699	63.289	60.871	63.062	*******	2.472	61.122	61.670
30.	9.136	38.640	72.210	61.329	63.472	66.808	64.246	61.306	64.132	*******	2.472	61.786	62.082
31.	9.265	35.478	83.587	62.655	62.404	73.040	64.453	62.518	65.248	*******	2.473	62.906	63.498
32.	9.360	35.246	70.531	62.405	62.291	69.069	64.613	62.405	65.067	*******	2.473	62.725	63.226
33.	9.456	35.022	66.427	62.269	62.063	67.083	64.636	62.223	64.840	*******	2.473	62.497	63.066
34.	9.552	34.803	65.341	62.111	62.042	66.338	64.569	62.065	64.887	*******	2.473	62.362	62.886
35.	9.647	34.614	64.774	61.951	63.068	65.794	64.547	61.905	64.774	*******	2.473	62.202	62.749
36.	9.743	34.356	64.639	61.793	63.594	65.592	64.594	61.770	64.685	*******	2.473	62.067	62.591
37.	9.838	34.176	64.324	61.659	63.824	65.346	64.574	61.636	64.733	*******	2.474	61.910	62.435
38.	9.934	33.978	64.301	61.476	64.120	65.368	64.460	61.453	64.688	*******	2.474	61.750	62.275
39.	10.030	33.806	64.257	61.340	64.030	65.097	64.416	61.317	64.666	*******	2.474	61.614	62.162
40.	10.125	33.643	64.121	61.227	64.167	65.053	64.371	61.204	64.599	*******	2.474	61.501	62.026

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITHOUT EXPLOSAFE - FILE NAME : TEST 14

DATE OF TEST : JAN 17, 1984 Q IN = 65 KW/M SQ LIQUID LEVEL = 50 PERCENT

SET PRESSURE = 35 PSIG PRV ORIFICE DIAMETER = 1/4 INCHES

	TIME MINS	PRESSURE PSIG	THRM#23 C	THRM#24 C	THRM#25 C	THRM#26 C	THRM#27 C	THRM#28 C	THRM#29 C	THRM#30 C	THRM#31 C	THRM#32 C	THRM#33 C
1.	0.139	-0.004	20.682	20.707	20.682	20.577	20.597	20.577	20.597	20.577	20.655	21.198	20.791
2.	0.596	0.137	20.695	20.695	20.670	21.164	21.532	21.551	21.571	20.678	21.551	21.823	22.017
3.	1.080	0.344	21.202	21.103	20.929	23.665	24.845	24.883	25.154	22.542	24.690	29.916	27.702
4.	1.605	0.919	21.462	22.130	21.784	28.515	30.036	30.420	31.170	29.170	32.419	45.401	35.582
5.	2.208	2.204	23.501	23.970	23.477	36.122	37.900	38.778	40.572	42.382	46.203	70.480	44.284
6.	2.813	3.962	27.249	27.616	27.200	45.637	47.667	49.164	52.172	60.012	63.879	106.610	51.567
7.	3.416	6.441	31.135	31.623	30.722	56.591	58.794	60.974	65.438	80.876	84.290	146.020	61.087
8.	4.024	9.470	34.677	34.991	34.581	69.201	71.610	74.072	79.821	104.230	108.140	176.050	58.420
9.	4.633	12.980	39.224	39.080	38.244	82.583	85.612	88.277	95.257	128.950	134.370	203.720	59.477
10.	5.264	17.526	42.967	43.109	43.654	97.602	101.140	104.850	111.400	155.320	162.540	233.530	61.624
11.	5.904	23.069	47.811	48.702	47.318	112.880	117.670	121.510	128.940	182.610	190.400	264.250	64.985
12.	6.571	30.171	54.163	54.001	54.302	128.520	135.110	138.650	146.950	211.080	217.030	295.880	66.674
13.	7.247	38.907	60.002	59.406	58.465	144.630	152.740	156.510	164.840	239.680	244.130	322.110	74.855
14.	7.372	32.234	60.164	60.279	60.348	142.530	152.140	153.810	162.040	244.960	248.870	326.670	75.212
15.	7.524	38.223	60.966	61.035	60.875	135.230	148.660	147.830	158.080	251.360	254.690	332.550	76.386
16.	7.650	34.004	62.087	62.042	61.973	134.590	148.900	147.590	157.570	256.600	259.410	337.390	77.204
17.	7.747	33.763	61.907	61.907	61.884	128.400	146.180	143.760	153.050	260.640	263.020	341.160	74.301
18.	7.843	33.531	61.748	61.771	61.748	125.990	145.600	142.780	150.660	264.600	266.530	344.810	78.897
19.	7.939	33.265	61.635	61.635	61.612	124.010	146.220	142.690	150.080	268.530	270.070	348.440	81.146
20.	8.034	33.024	61.476	61.476	61.476	122.750	147.740	143.530	150.910	272.460	273.550	352.030	82.483
21.	8.186	38.120	61.889	61.980	61.980	128.550	153.990	149.280	158.030	278.720	278.920	357.720	82.261
22.	8.312	34.902	62.939	62.917	62.917	132.410	156.600	151.480	160.930	283.870	283.340	362.380	81.964
23.	8.408	34.663	62.735	62.735	62.713	130.660	156.490	151.020	159.170	287.770	286.810	365.950	83.506
24.	8.503	34.378	62.554	62.577	62.531	129.440	158.000	152.420	159.480	291.660	290.130	369.400	83.153
25.	8.599	34.120	62.372	62.372	62.350	129.240	159.550	153.110	160.860	295.550	293.490	372.880	84.395
26.	8.694	33.875	62.191	62.191	62.168	129.320	161.250	154.880	162.900	299.380	296.780	376.330	85.100
27.	8.790	33.613	62.010	62.010	61.987	129.990	164.220	157.730	164.620	303.240	300.010	379.700	86.453
28.	8.885	35.385	61.828	61.828	61.828	130.370	166.280	158.900	166.990	307.060	303.230	383.310	88.785
29.	8.981	33.158	61.670	61.670	61.670	131.470	168.020	160.700	167.660	310.870	306.460	386.480	90.431
30.	9.136	38.640	62.037	62.333	62.288	136.690	172.210	165.390	175.980	317.060	311.630	392.090	91.300
31.	9.265	35.478	63.498	63.430	63.430	144.840	174.310	168.690	178.960	322.120	315.880	396.420	93.977
32.	9.360	35.246	63.226	63.249	63.203	141.650	174.220	168.380	177.190	325.850	318.920	399.470	97.775
33.	9.456	35.022	63.044	63.066	63.066	141.010	176.310	169.210	177.540	329.560	321.980	402.660	98.530
34.	9.552	34.803	62.886	62.909	62.886	140.560	178.420	170.710	177.700	333.360	324.980	405.860	99.084
35.	9.647	34.614	62.749	62.726	62.726	141.290	180.210	172.430	178.800	337.000	328.000	409.010	100.100
36.	9.743	34.356	62.591	62.591	62.569	141.830	182.480	174.610	180.120	340.730	330.990	412.190	100.810
37.	9.838	34.176	62.435	62.435	62.435	141.180	184.220	174.870	181.220	344.410	333.940	415.290	101.900
38.	9.934	33.578	62.298	62.275	62.298	142.050	186.510	176.300	182.180	348.030	336.840	418.220	102.320
39.	10.030	33.806	62.162	62.162	62.162	143.440	188.350	177.290	183.260	351.730	339.760	421.300	103.540
40.	10.125	33.643	62.049	62.049	62.026	144.800	190.170	179.800	185.160	355.290	342.600	424.670	104.930

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITHOUT EXPLOSAFE - FILE NAME : TEST 14

DATE OF TEST : JAN 17, 1984 Q IN = 65 KW/M SQ LIQUID LEVEL = 50 PERCENT

SET PRESSURE = 35 PSIG PRV ORIFICE DIAMETER = 1/4 INCHES

	TIME MINS	PRESSURE PSIG	THRM#34 C	THRM#35 C	THRM#36 C	THRM#37 C	THRM#38 C	THRM#39 C	THRM#40 C	THRM#41 C	THRM#42 C	THRM#43 C
1.	0.139	-0.004	20.577	20.539	20.442	20.480	20.616	20.674	2.439	20.500	20.325	20.364
2.	0.596	0.137	23.605	21.803	22.191	22.540	21.610	20.659	2.440	20.484	20.329	20.368
3.	1.080	0.344	26.525	23.549	24.439	24.033	24.690	20.680	2.440	20.525	20.331	20.370
4.	1.605	0.919	36.366	25.660	27.224	26.297	29.266	20.704	2.440	20.529	20.374	20.393
5.	2.208	2.204	50.239	26.572	29.655	29.693	28.172	20.805	2.441	20.572	20.475	20.514
6.	2.813	3.962	65.584	29.871	30.159	29.620	31.044	20.984	2.441	20.731	20.693	20.751
7.	3.416	6.441	83.010	33.275	34.444	33.121	34.981	21.298	2.442	21.007	21.104	21.220
8.	4.024	9.470	102.180	37.376	38.369	37.299	38.598	21.805	2.442	21.476	21.766	21.960
9.	4.633	12.980	122.580	41.540	42.625	41.940	42.758	22.565	2.442	22.177	22.720	23.030
10.	5.264	17.526	144.260	46.260	46.279	45.824	47.512	23.635	2.443	23.228	24.061	24.505
11.	5.904	23.069	166.990	50.068	51.625	50.679	52.740	25.031	2.443	24.587	25.843	26.460
12.	6.571	30.171	190.440	56.741	57.250	56.911	58.323	26.888	2.443	26.406	28.161	28.931
13.	7.247	38.907	213.840	63.268	62.967	63.174	64.205	29.224	2.444	28.646	30.974	31.973
14.	7.372	32.234	217.030	60.680	61.131	60.661	60.492	29.727	2.444	29.111	31.573	32.591
15.	7.524	36.223	217.830	63.478	63.965	64.003	64.153	30.325	2.444	29.709	32.227	33.340
16.	7.650	34.004	221.880	62.071	62.446	62.089	61.920	30.844	2.444	30.209	32.880	34.011
17.	7.747	33.763	223.010	61.903	62.334	61.940	61.752	31.229	2.444	30.614	33.322	34.511
18.	7.843	33.581	224.620	61.752	62.184	61.715	61.602	31.633	2.444	30.999	33.763	35.009
19.	7.939	33.265	226.780	61.603	62.072	61.603	61.434	32.056	2.444	31.403	34.224	35.488
20.	8.034	33.024	229.010	61.398	61.923	61.435	61.247	32.499	2.445	31.808	34.723	36.025
21.	8.186	38.120	234.000	63.763	64.475	63.800	64.531	33.191	2.445	32.500	35.567	36.858
22.	8.312	34.902	239.330	62.900	63.257	62.881	62.675	33.804	2.445	33.075	36.352	37.652
23.	8.408	34.653	241.080	62.733	63.090	62.696	62.508	34.266	2.445	33.557	36.870	38.227
24.	8.503	34.378	243.110	62.621	62.940	62.508	62.320	34.745	2.445	33.998	37.386	38.800
25.	8.599	34.120	245.980	62.189	62.752	62.320	62.151	35.205	2.445	34.439	37.883	39.353
26.	8.694	33.875	249.150	62.002	62.622	62.115	61.946	35.685	2.445	34.938	38.419	39.927
27.	8.790	33.613	252.370	61.872	62.397	61.966	61.778	36.183	2.445	35.399	38.974	40.538
28.	8.885	33.385	255.270	61.703	62.210	61.778	61.609	36.700	2.445	35.896	39.546	41.129
29.	8.981	33.158	258.320	61.591	62.004	61.610	61.441	37.217	2.445	36.395	40.139	41.740
30.	9.136	38.640	263.980	64.856	64.500	64.087	66.916	38.059	2.445	37.218	41.207	42.788
31.	9.265	35.478	269.170	63.319	63.731	63.337	63.187	38.804	2.445	37.944	42.198	43.720
32.	9.360	35.246	270.470	63.113	63.620	63.188	62.982	39.377	2.445	38.499	42.789	44.386
33.	9.456	35.022	272.110	62.944	63.338	63.019	62.813	39.912	2.445	39.015	43.340	45.032
34.	9.552	34.803	274.670	62.759	63.228	62.871	62.627	40.486	2.446	39.570	43.932	45.680
35.	9.647	34.614	278.080	62.570	63.058	62.683	62.570	41.038	2.446	40.122	44.577	46.363
36.	9.743	34.356	280.570	62.422	62.891	62.497	62.122	41.630	2.446	40.716	45.206	47.029
37.	9.838	34.176	283.240	62.292	62.742	62.385	62.179	42.241	2.446	41.269	45.872	47.712
38.	9.934	33.978	285.410	62.216	62.648	62.254	62.592	42.812	2.446	41.860	46.517	48.433
39.	10.030	33.806	288.820	62.050	62.575	61.974	63.850	43.403	2.446	42.452	47.183	49.117
40.	10.125	33.643	291.620	61.938	62.426	61.994	66.923	44.032	2.446	43.062	47.867	49.837

PLOTS OF A TEST

CARRIED OUT ON THE UNB TANK 2

WITHOUT EXPLOSAFE

TEST NUMBER 15

Q in = 65 kW/m sq

LIQUID LEVEL = 23 %

SET PRESSURE = 35 psig

PRV ORIFICE DIAMETER = 1/4 in.

Date of Test JAN 18, 1984

TABLE OF CONTENTS

Thermocouple Grid Layout - - - - - - - - - - - -

1. For the Thermocouples Placed in a Vertical Line:
   (a) Plots of Temperature Vs Time - - - - - - -
   (b) Plots of Height Vs. Temperature - - - - - -

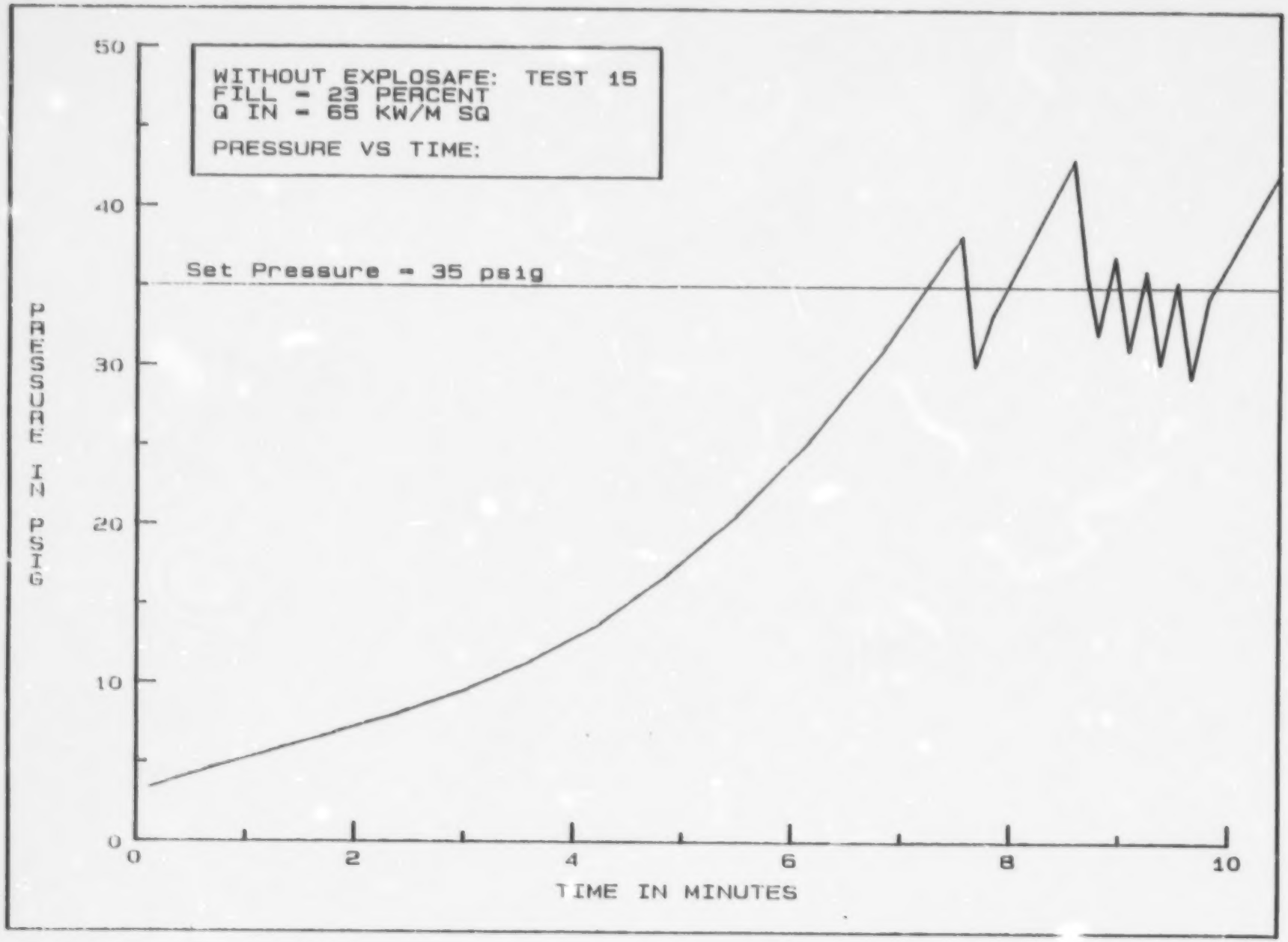
2. Thermocouples Placed in the Four Quadrants
   in a Vertical Plane: Temp. Vs. Time - - - - -

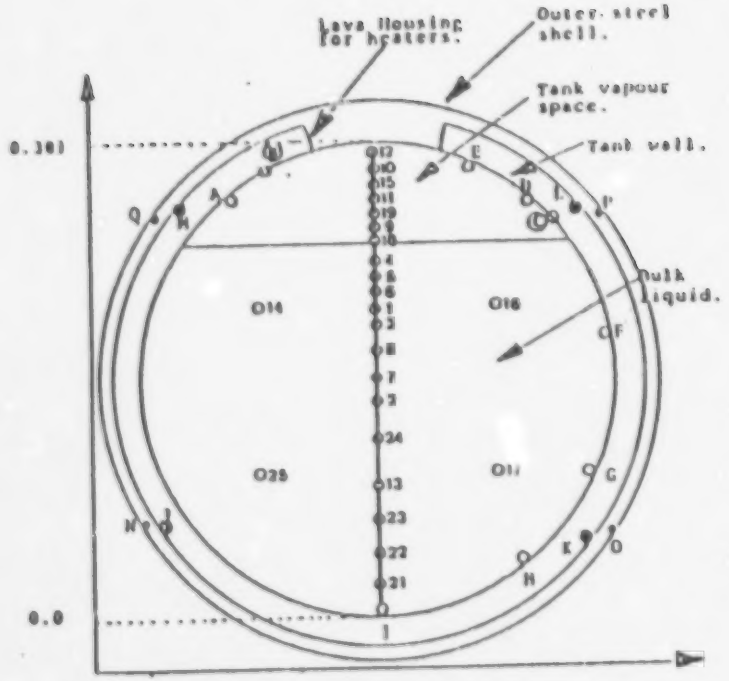
Thermocouple Grid Layout - - - - - - - - - - - -

3. Thermocouples Placed On and Inside the
   Mild Steel Shell: Temp. Vs. Time - - - - - -

4. Thermocouples Placed in the Lava Medium
   Temp. Vs. Time - - - - - - - - - - - - - - -

6. Print out of Data - - - - - - - - - - - - -


WITHOUT EXPLOSAFE: TEST 15
FILL - 23 PERCENT
Q IN - 65 KW/M SQ
PRESSURE VS TIME:
Set Pressure - 35 psig
PRESSURE IN PSIG
TIME IN MINUTES
0
10
20
30
40
50
0
2
4
6
8
10



SYMBOL	Thermocouple #.	Angle (Deg)
A	26	310
B	36	20
C	27	56
D & E	28 & 29	48 & 25
F & G	38 & 35	78 & 110
H & I	37 & 34	142 & 180
J & K	30 & 31	133 & 220
L & M	32 & 33	50 & 300
N & O	42 & 43	140 & 230
P & Q	39 & 41	60 & 310

○ Circled thermocouples are inserted inside the vapour space wall.

Number 44 represents pressure(vessel) in psig.
Number 45 represents time in seconds.
Reference upper diameter = 45.47 cms.

Thermocouple numbers.	Height (cm)	Angle with the vertical (Deg.)	Doubtful or faulty Thermocouple.
12	42.57	-	-
10	41.545	-	-
15	40.495	-	-
11	39.475	-	-
19	38.55	-	YES.
09	37.575	-	-
18	36.595	-	-
04	34.62	-	-
05	33.59	-	-
06	32.60	-	-
01	31.16	-	-
03	30.63	-	YES.
08	29.61	-	-
07	27.635	-	-
02	24.72	-	-
24	22.87	-	-
13	21.83	-	-
23	17.82	-	-
22	14.38	-	-
21	10.34	-	-
36	07.63	180	-
26	-	310	-
27 & 28	-	56 & 48	-
29 & 38	-	25 & 78	-
35 & 37	-	110 & 142	-
30 & 31	-	133 & 220	-
33 & 34	-	300 & 20	YES.
32 & 39	-	50 & 60	-
41 & 42	-	310 & 140	-
43	-	230	-
14	31.2	-	-
16	31.2	-	-
25	22.8	-	-
17	22.8	-	-
20 & 40	Reference Temperature	-	-

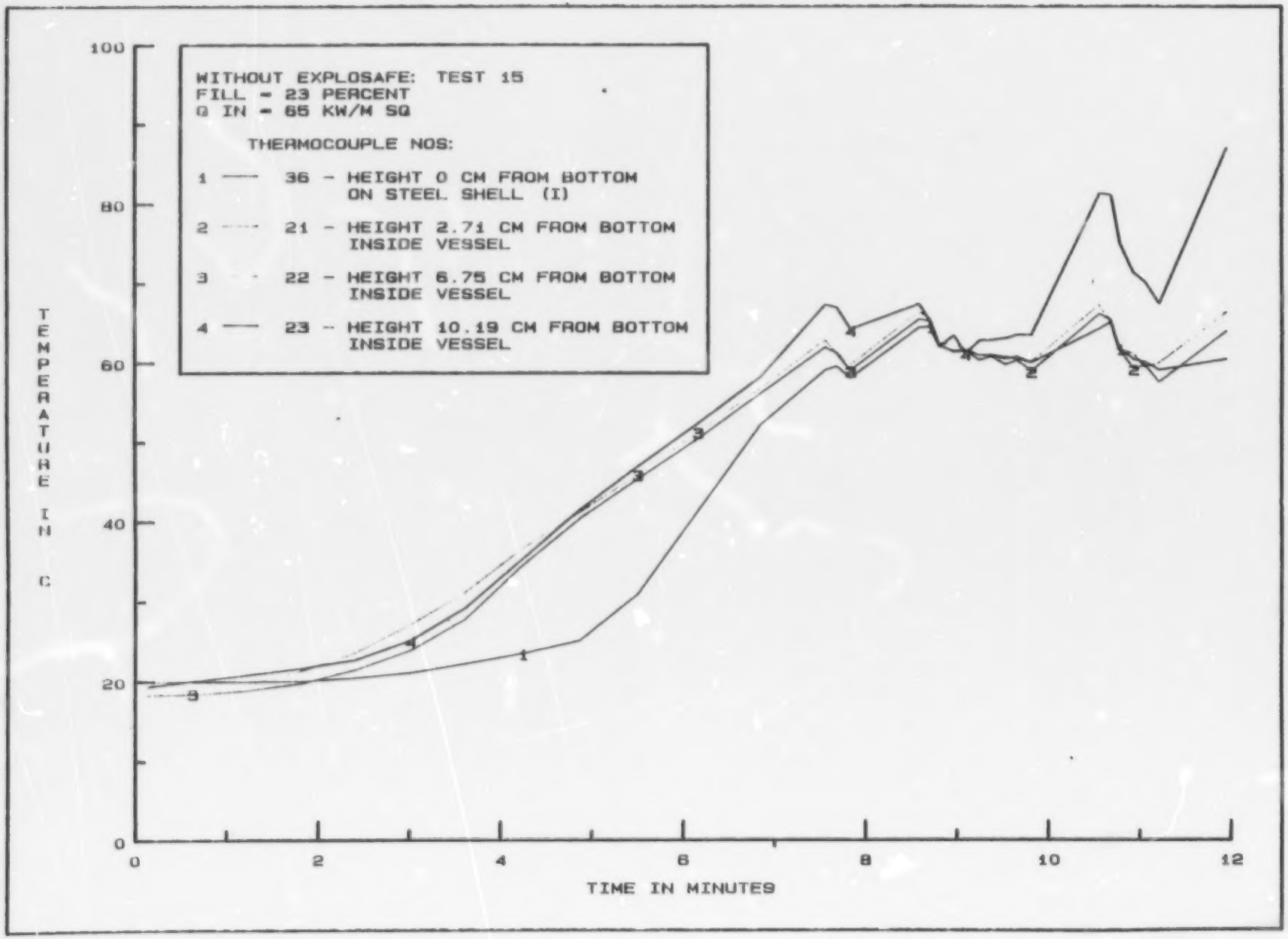
Fig. III.A A grid layout of thermocouples along with their locations for an unprotected vessel(UNB) with the PRV orifice of 1/4 in. (Valid for 76, 58 and 23 percent liquid full cases)

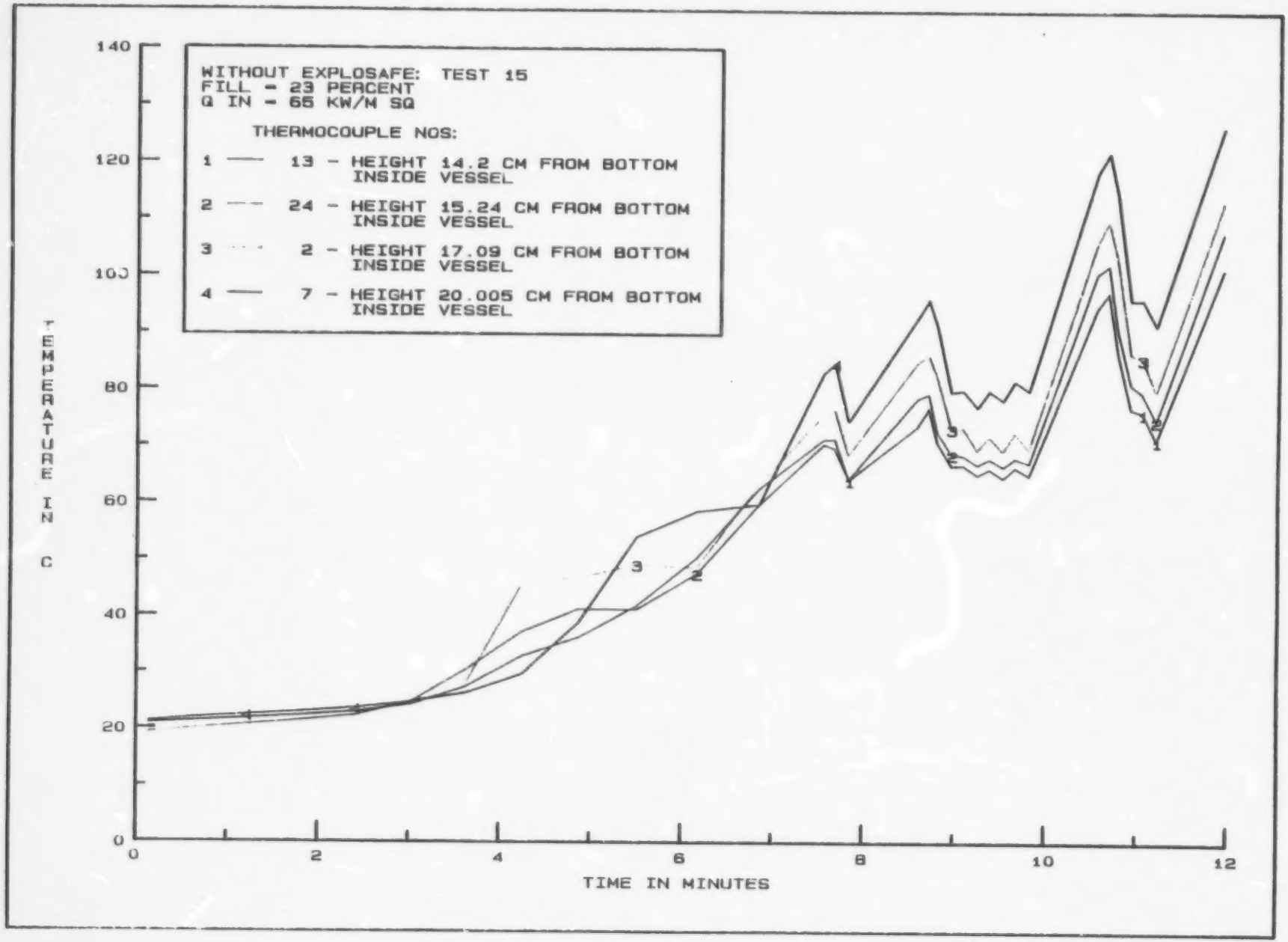
FOLLOWING THERMOCOUPLES ARE PLACED

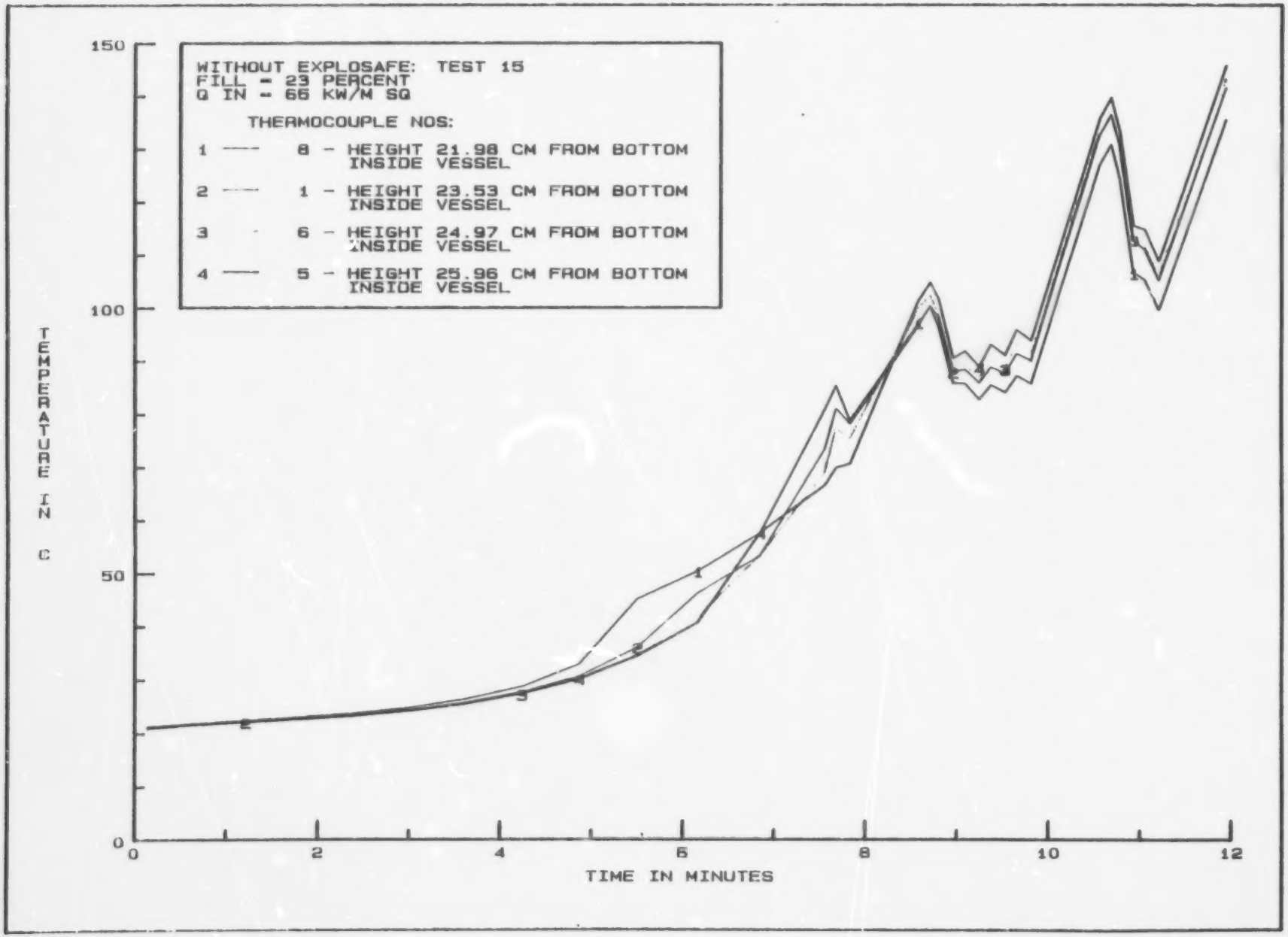
AT THE CENTRE OF THE VESSEL (DIA. 38.1 CM)

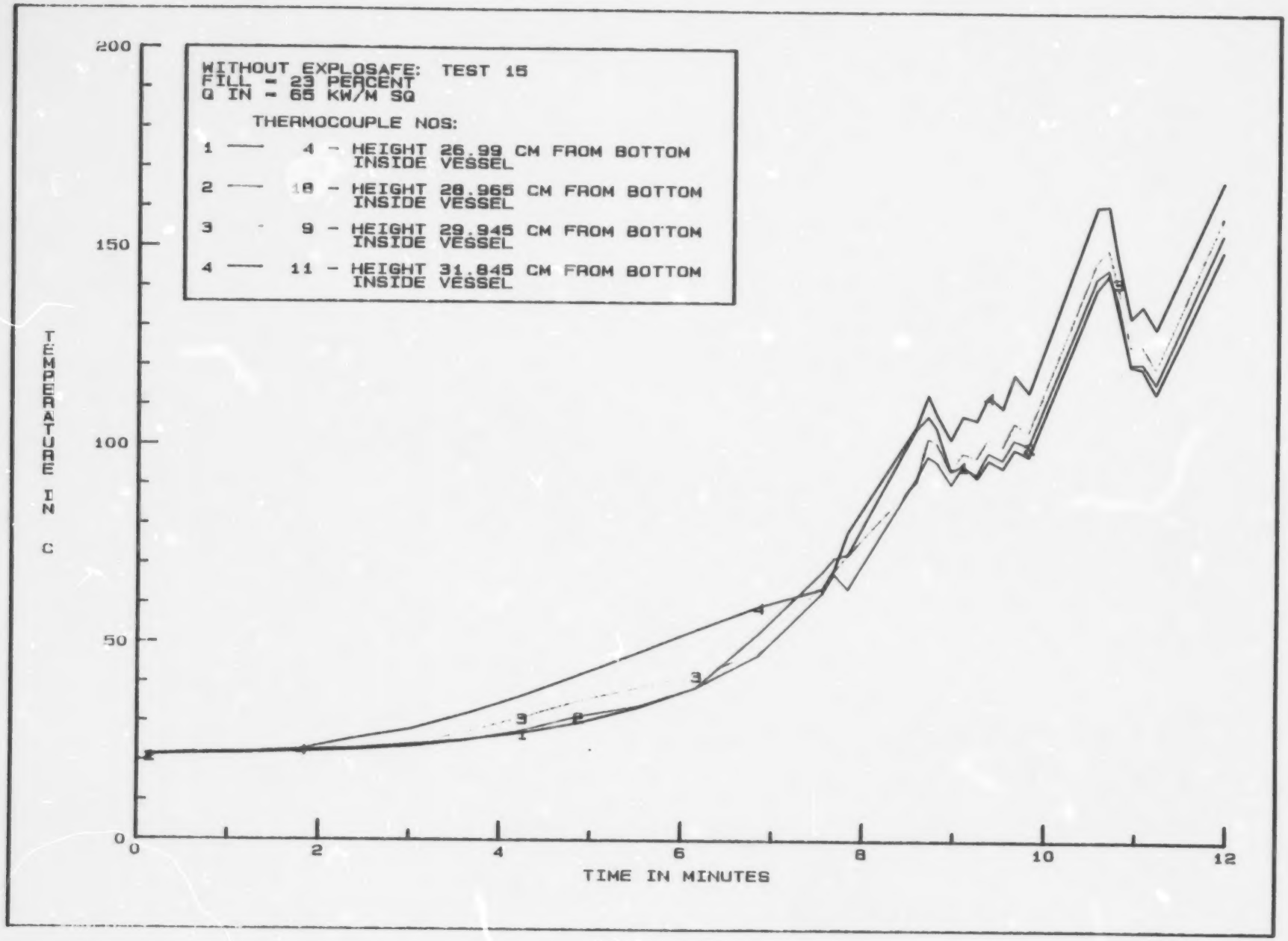
IN A VERTICLE AXIS

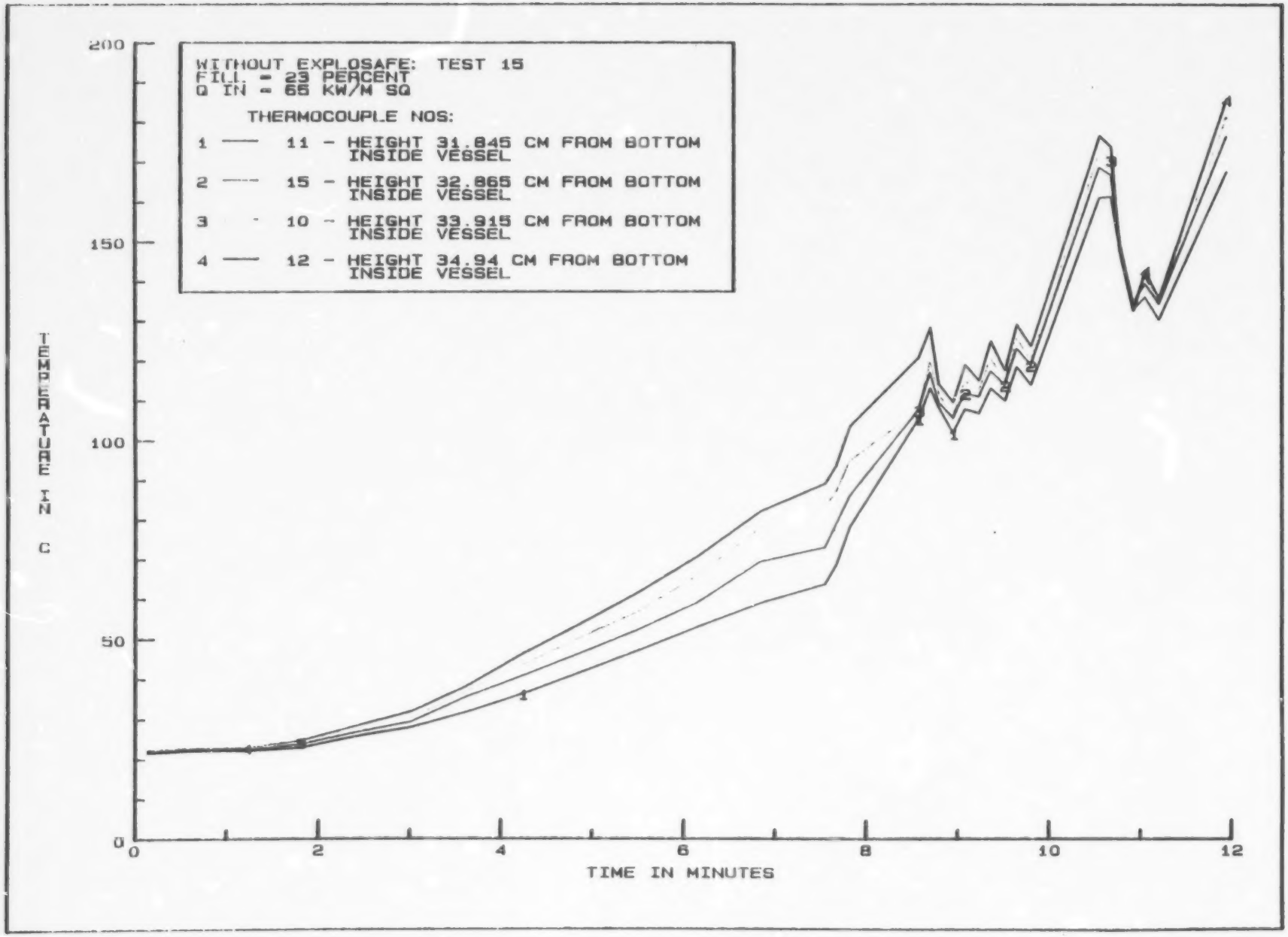
THERMOCOUPLE NUM.	HEIGHT FROM BOTTOM IN CM
36 OR I	0
21	2.71
22	6.75
23	10.19
13	14.2
24	15.24
2	17.09
7	20.005
8	21.98
1	23.53
6	24.97
5	25.98
4	26.89
10	28.965
9	29.945
11	31.845
12	32.865
35	33.915
32	34.94


WITHOUT EXPLOSAFE: TEST 15
FILL - 23 PERCENT
Q IN - 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 36 - HEIGHT 0 CM FROM BOTTOM ON STEEL SHELL (I)
2 - - - 21 - HEIGHT 2.71 CM FROM BOTTOM INSIDE VESSEL
3 · 22 - HEIGHT 6.75 CM FROM BOTTOM INSIDE VESSEL
4 —— 23 - HEIGHT 10.19 CM FROM BOTTOM INSIDE VESSEL
TEMPERATURE IN C
100
80
60
40
20
0
0
2
4
6
8
10
12
TIME IN MINUTES


WITHOUT EXPLOSAFE: TEST 15
FILL - 23 PERCENT
Q IN - 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 13 - HEIGHT 14.2 CM FROM BOTTOM INSIDE VESSEL
2 — — 24 - HEIGHT 15.24 CM FROM BOTTOM INSIDE VESSEL
3 · · · 2 - HEIGHT 17.09 CM FROM BOTTOM INSIDE VESSEL
4 —— 7 - HEIGHT 20.005 CM FROM BOTTOM INSIDE VESSEL
TEMPERATURE IN C
140
120
100
80
60
40
20
0
0
2
4
6
8
10
12
TIME IN MINUTES


WITHOUT EXPLOSAFE: TEST 15
FILL = 23 PERCENT
Q IN = 66 KW/M SQ
THERMOCOUPLE NOS:
1 ---- 8 - HEIGHT 21.98 CM FROM BOTTOM INSIDE VESSEL
2 ---- 1 - HEIGHT 23.53 CM FROM BOTTOM INSIDE VESSEL
3 - 6 - HEIGHT 24.97 CM FROM BOTTOM INSIDE VESSEL
4 ---- 5 - HEIGHT 25.96 CM FROM BOTTOM INSIDE VESSEL
TEMPERATURE IN C
150
100
50
0
0
2
4
6
8
10
12
TIME IN MINUTES


WITHOUT EXPLOSAFE: TEST 15
FILL - 23 PERCENT
Q IN - 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 4 - HEIGHT 26.99 CM FROM BOTTOM INSIDE VESSEL
2 —— 10 - HEIGHT 28.965 CM FROM BOTTOM INSIDE VESSEL
3 - 9 - HEIGHT 29.945 CM FROM BOTTOM INSIDE VESSEL
4 —— 11 - HEIGHT 31.845 CM FROM BOTTOM INSIDE VESSEL
TEMPERATURE IN C
200
150
100
50
0
0
2
4
6
8
10
12
TIME IN MINUTES


WITHOUT EXPLOSAFE: TEST 15
FILL = 23 PERCENT
Q IN = 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 11 - HEIGHT 31.845 CM FROM BOTTOM INSIDE VESSEL
2 —— 15 - HEIGHT 32.865 CM FROM BOTTOM INSIDE VESSEL
3 - 10 - HEIGHT 33.915 CM FROM BOTTOM INSIDE VESSEL
4 —— 12 - HEIGHT 34.94 CM FROM BOTTOM INSIDE VESSEL
TEMPERATURE IN C
200
150
100
50
0
0
2
4
6
8
10
12
TIME IN MINUTES

FOLLOWING ARE HEIGHT VS TEMPERATURE

PLOTS FOR THE

THERMOCOUPLES PLACED AT THE CENTRE

OF THE VESSEL

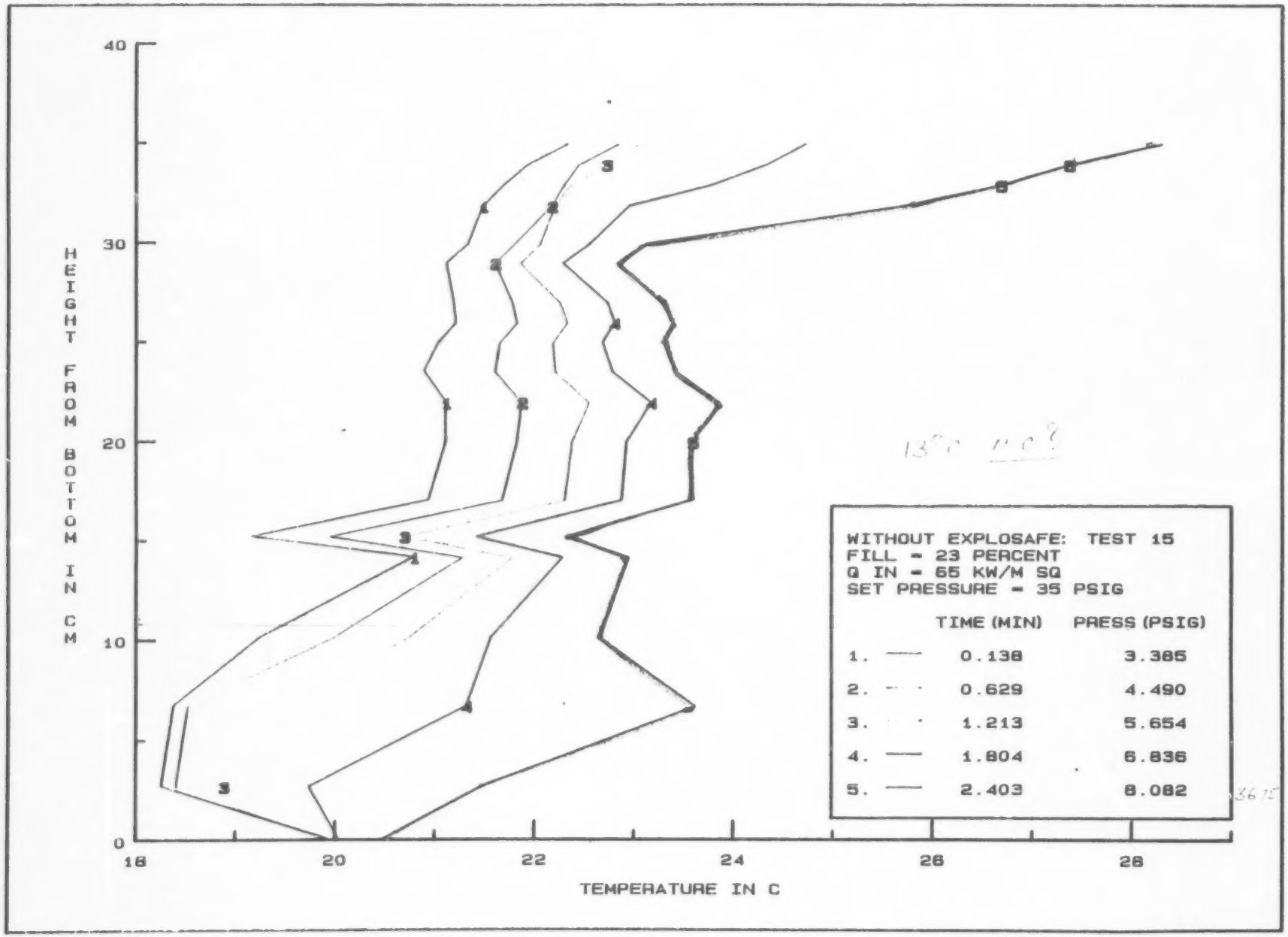
IN A VERTICAL AXIS

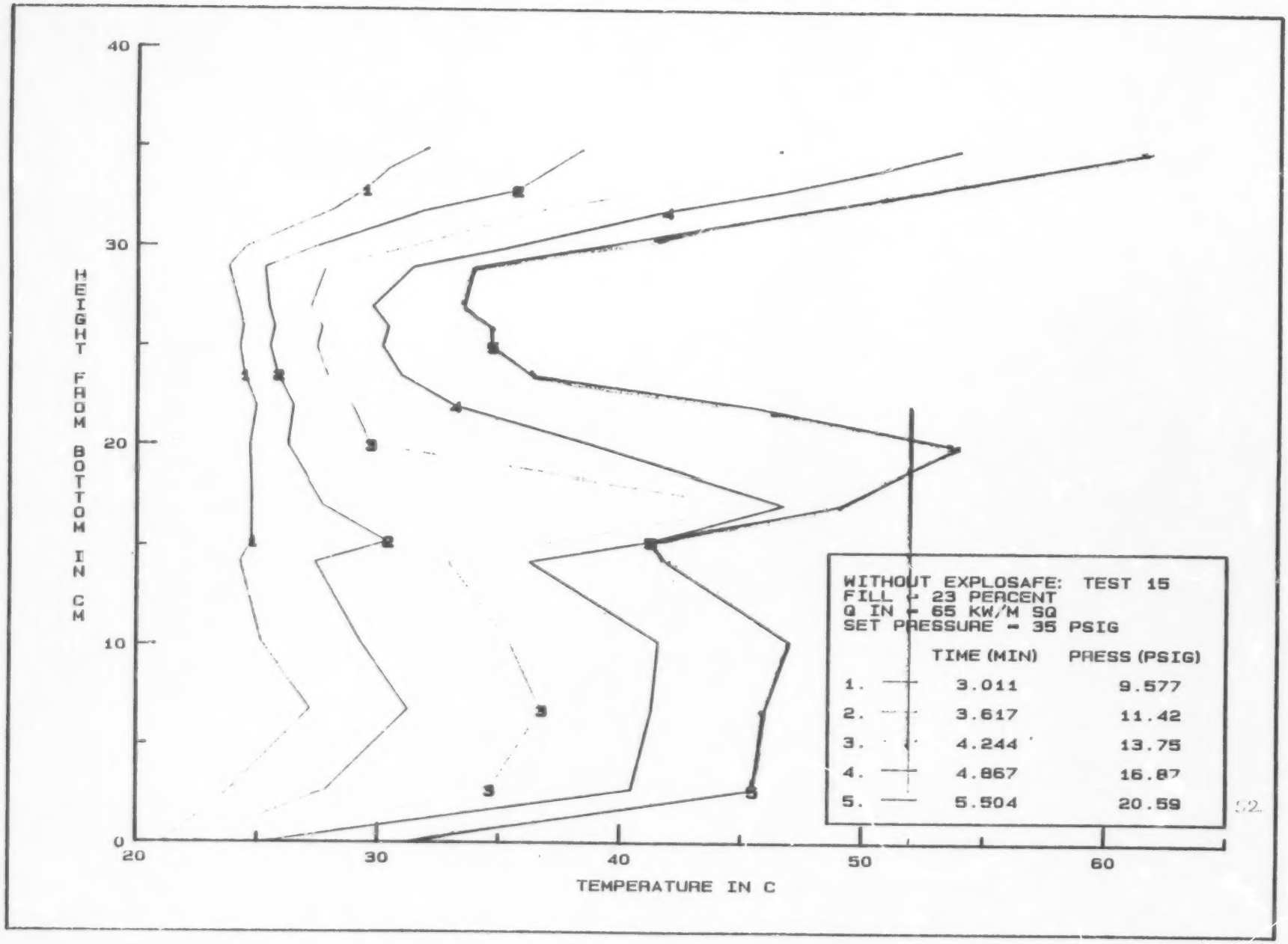
EACH PLOT REPRESENTS ONE SCAN OF

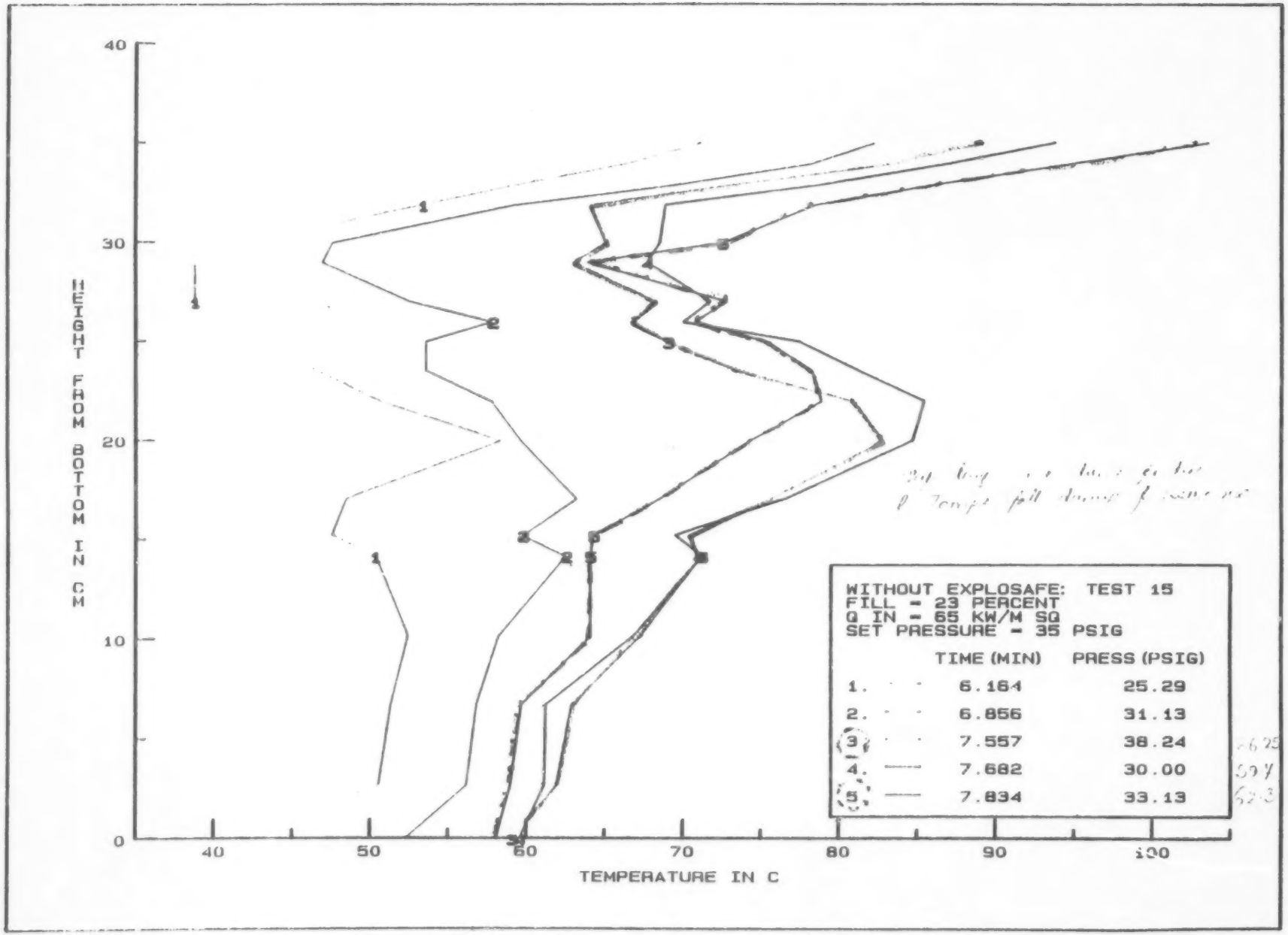
ALL THE THERMOCOUPLES

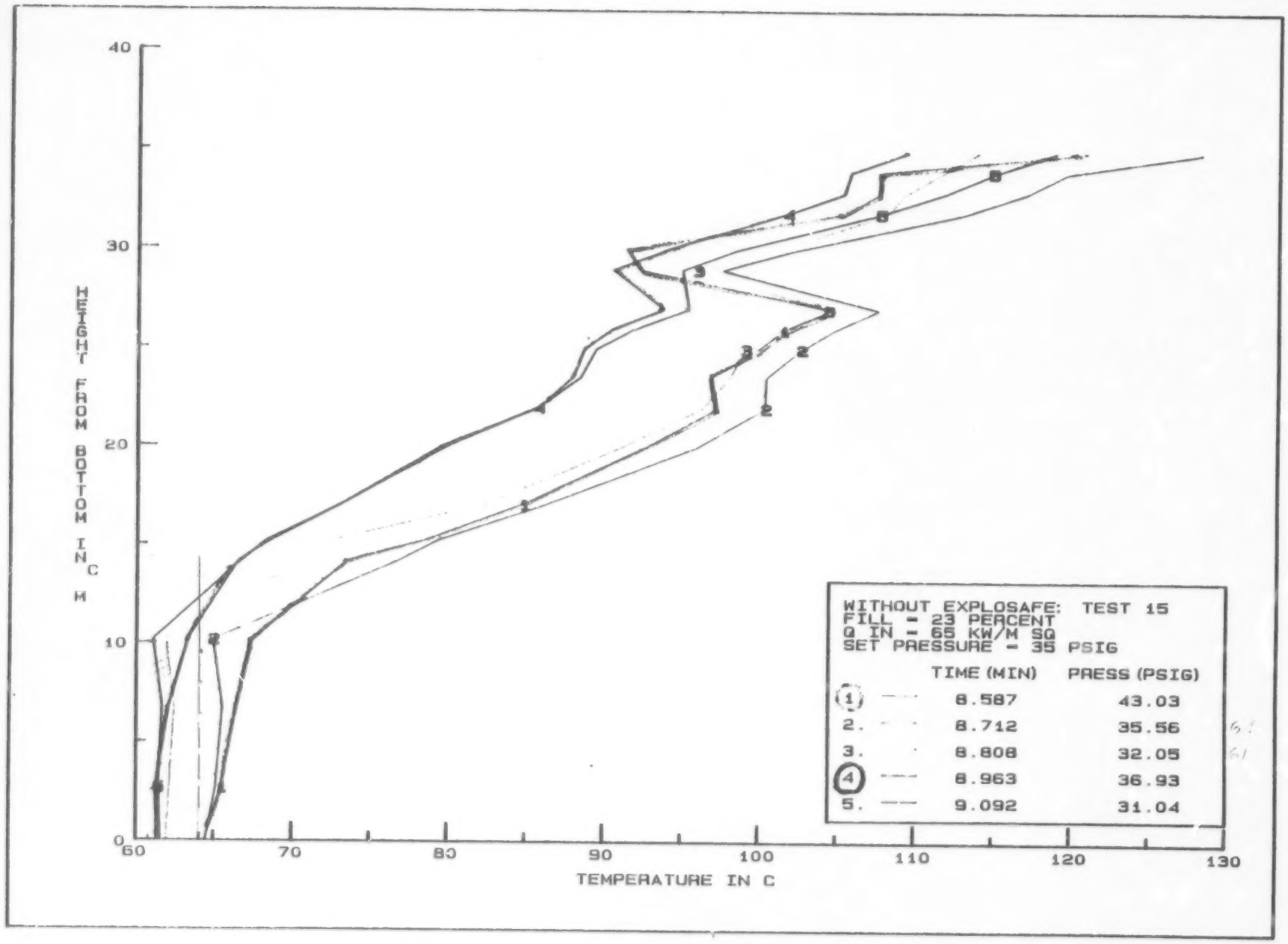
PLOTS ARE GIVEN AS FIVE (5) SCANS

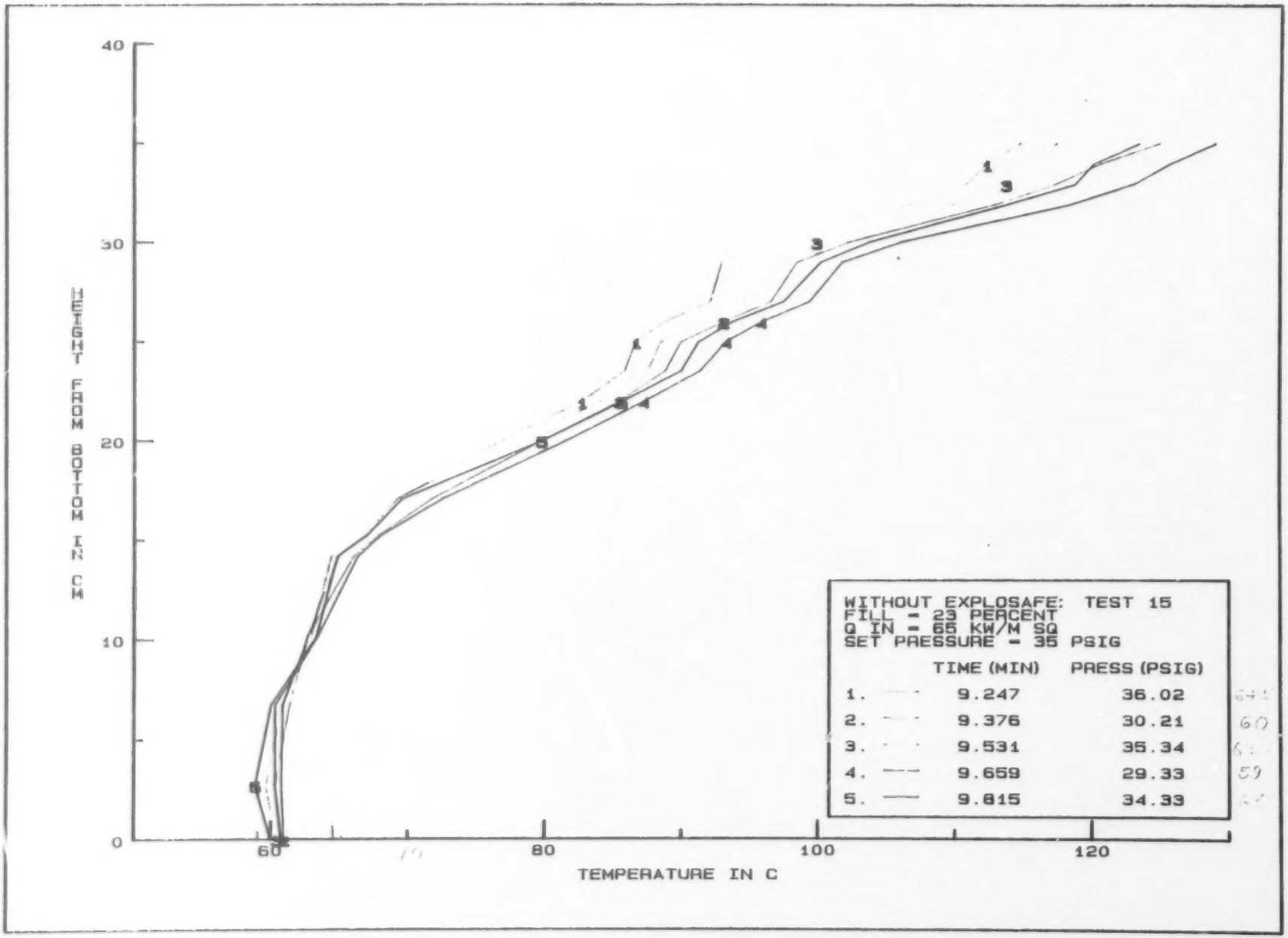
PER PAGE

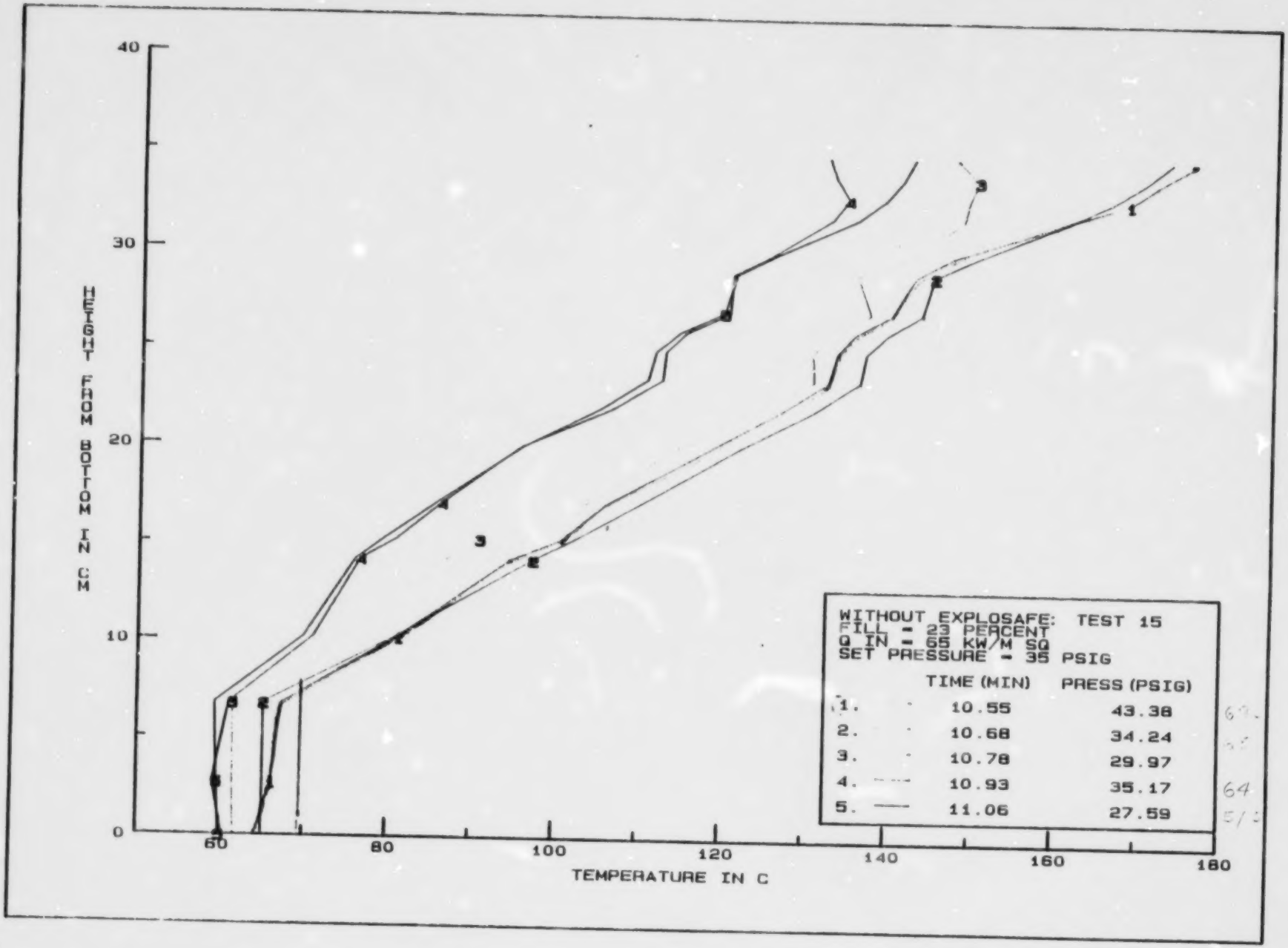

HEIGHT FROM BOTTOM IN CM
0
10
20
30
40
18
20
22
24
26
28
TEMPERATURE IN C
WITHOUT EXPLOSAFE: TEST 15
FILL - 23 PERCENT
Q IN - 65 KW/M SQ
SET PRESSURE - 35 PSIG
TIME (MIN) PRESS (PSIG)
1. 0.138 3.385
2. 0.629 4.490
3. 1.213 5.654
4. 1.804 6.836
5. 2.403 8.082

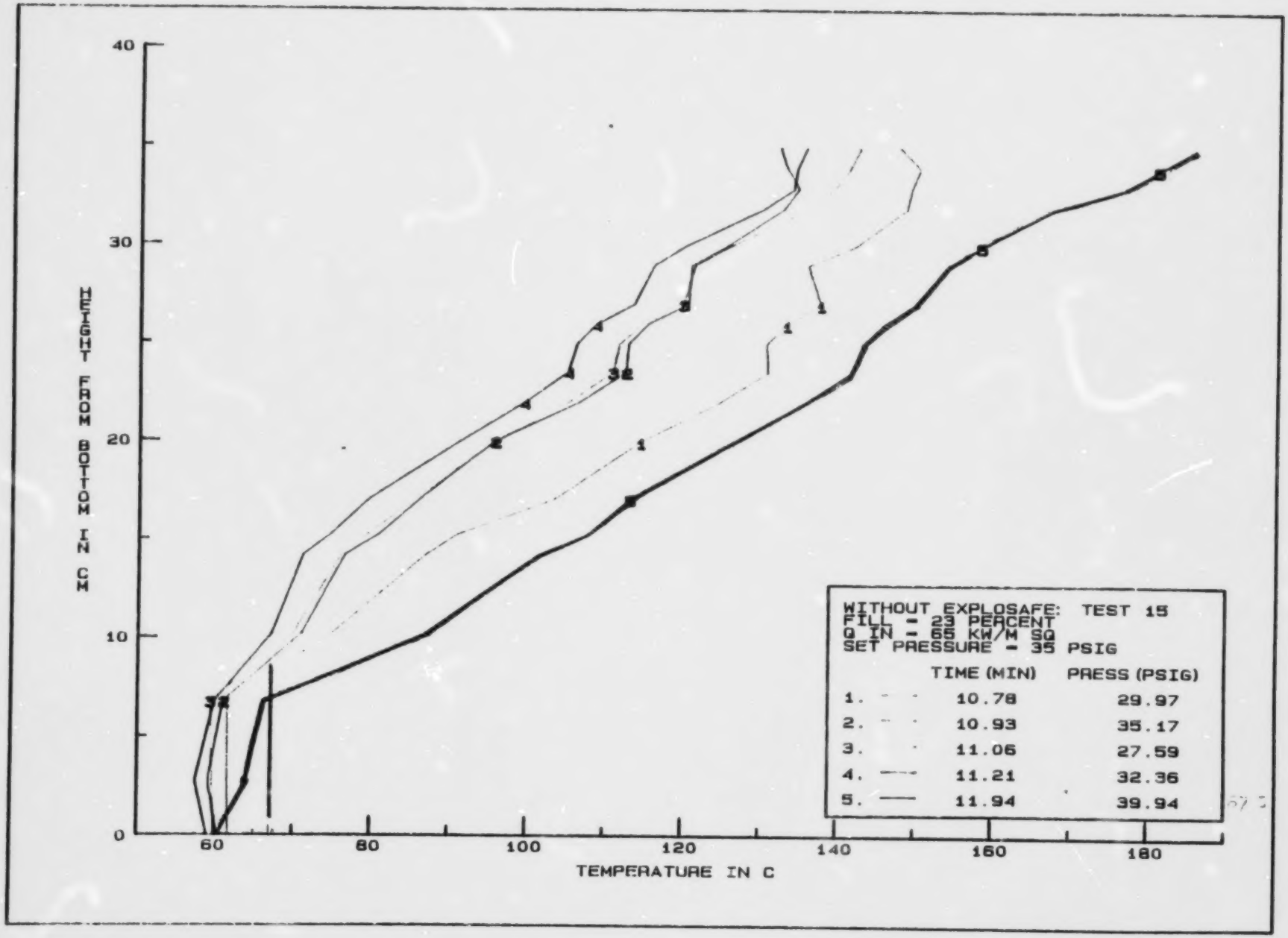

HEIGHT FROM BOTTOM IN CM
TEMPERATURE IN C
0
10
20
30
40
20
30
40
50
60
WITHOUT EXPLOSAFE: TEST 15
FILL = 23 PERCENT
Q IN = 65 KW/M SQ
SET PRESSURE = 35 PSIG
TIME (MIN) PRESS (PSIG)
1. 3.011 9.577
2. 3.617 11.42
3. 4.244 13.75
4. 4.867 16.87
5. 5.504 20.59


HEIGHT FROM BOTTOM IN CM
TEMPERATURE IN C
0
10
20
30
40
40
50
60
70
80
90
100
WITHOUT EXPLOSAFE: TEST 15
FILL - 23 PERCENT
Q IN - 65 KW/M SQ
SET PRESSURE - 35 PSIG
TIME (MIN) PRESS (PSIG)
1. 6.164 25.29
2. 6.856 31.13
3. 7.557 38.24
4. 7.682 30.00
5. 7.834 33.13


HEIGHT FROM BOTTOM IN C M
0
10
20
30
40
60
70
80
90
100
110
120
130
TEMPERATURE IN C
WITHOUT EXPLOSAFE: TEST 15
FILL - 23 PERCENT
Q IN - 65 KW/M SQ
SET PRESSURE - 35 PSIG
TIME (MIN) PRESS (PSIG)
1. 8.587 43.03
2. 8.712 35.56
3. 8.808 32.05
4. 8.963 36.93
5. 9.092 31.04

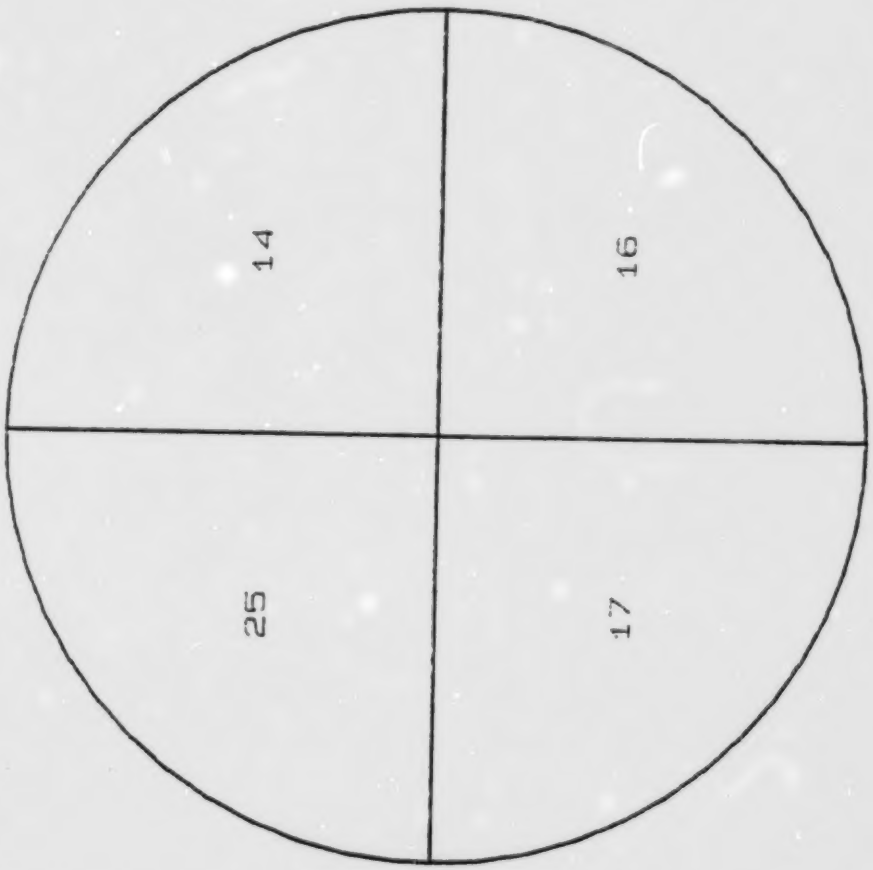

40
30
20
10
0
HEIGHT FROM BOTTOM IN CM
60
80
100
120
TEMPERATURE IN C
WITHOUT EXPLOSAFE: TEST 15
FILL - 23 PERCENT
Q IN - 65 KW/M SQ
SET PRESSURE - 35 PSIG
TIME (MIN) PRESS (PSIG)
1. 9.247 36.02
2. 9.376 30.21
3. 9.531 35.34
4. 9.659 29.33
5. 9.815 34.33


HEIGHT FROM BOTTOM IN CM
40
30
20
10
0
60
80
100
120
140
160
180
TEMPERATURE IN C
WITHOUT EXPLOSAFE: TEST 15
FILL - 23 PERCENT
Q IN - 65 KW/M SQ
SET PRESSURE - 35 PSIG
TIME (MIN) PRESS (PSIG)
1. 10.55 43.38
2. 10.68 34.24
3. 10.78 29.97
4. 10.93 35.17
5. 11.06 27.59


HEIGHT FROM BOTTOM IN CM
0
10
20
30
40
60
80
100
120
140
160
180
TEMPERATURE IN C
WITHOUT EXPLOSAFE: TEST 15
FILL - 23 PERCENT
Q IN - 65 KW/M SQ
SET PRESSURE - 35 PSIG
TIME (MIN) PRESS (PSIG)
1. 10.78 29.97
2. 10.93 35.17
3. 11.06 27.59
4. 11.21 32.36
5. 11.94 39.94

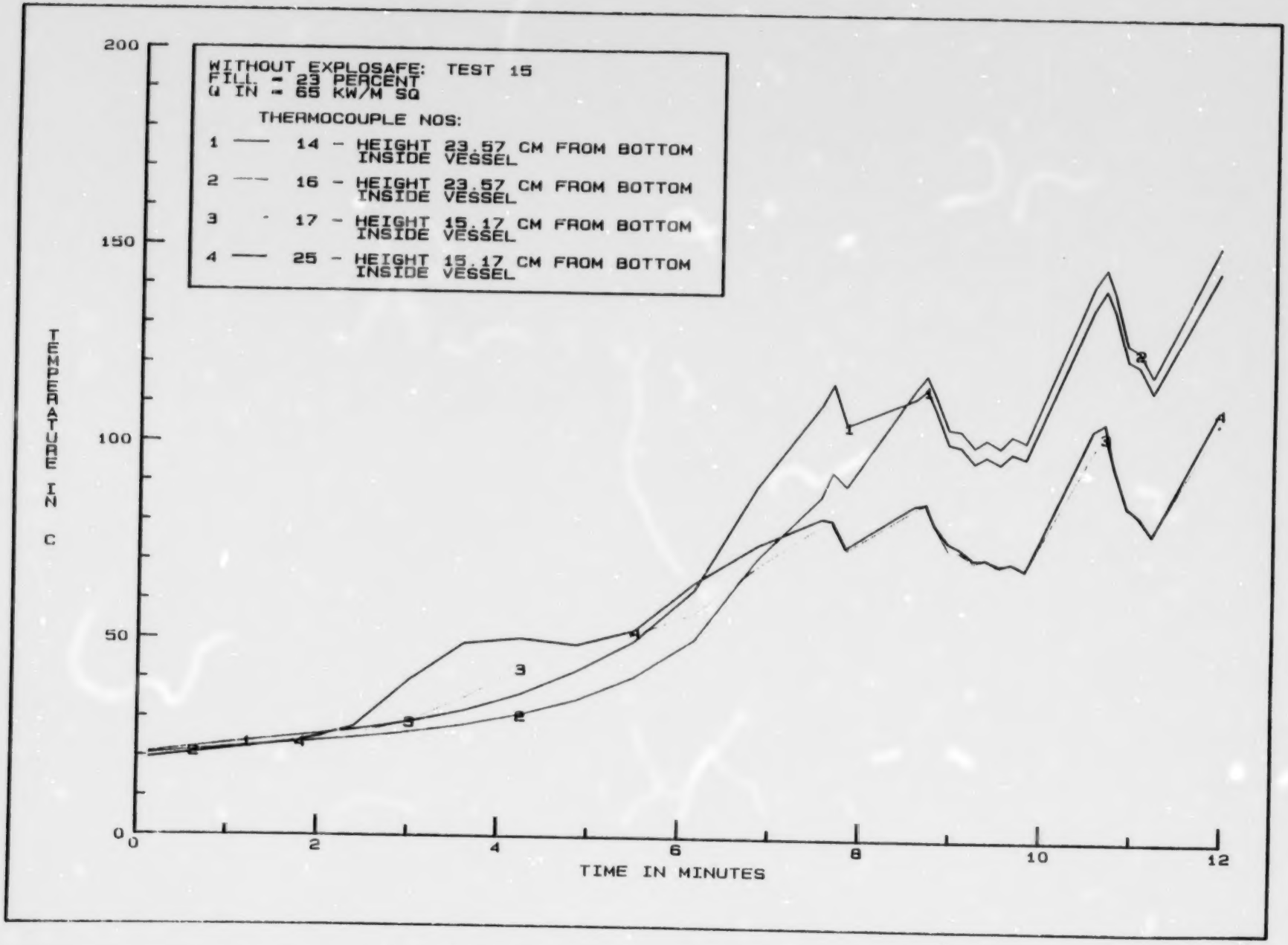
FOLLOWING FOUR THERMOCOUPLES ARE PLACED

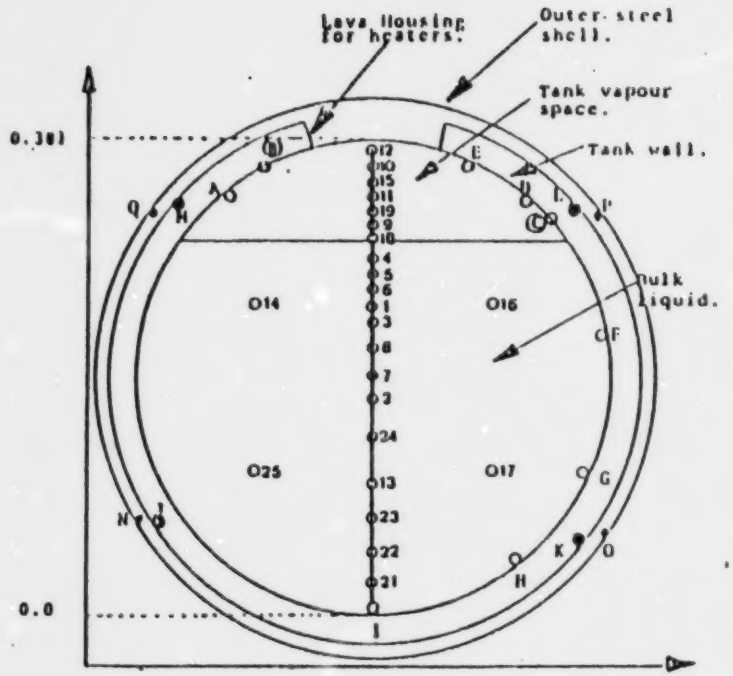
AT THE FOUR QUADRANTS ON A VERTICAL PLANE



THERMOCOUPLE NUM.	HEIGHT FROM BOTTOM IN CM
14 AND 16	23.57
25 AND 17	15.17

PLOTS ARE GIVEN TWO PER PAGE


WITHOUT EXPLOSAFE: TEST 15
FILL = 23 PERCENT
Q IN = 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 14 - HEIGHT 23.57 CM FROM BOTTOM INSIDE VESSEL
2 —— 16 - HEIGHT 23.57 CM FROM BOTTOM INSIDE VESSEL
3 · 17 - HEIGHT 15.17 CM FROM BOTTOM INSIDE VESSEL
4 —— 25 - HEIGHT 15.17 CM FROM BOTTOM INSIDE VESSEL
TEMPERATURE IN C
200
150
100
50
0
0
2
4
6
8
10
12
TIME IN MINUTES



SYMBOL	Thermocouple #.	Angle (Deg)
A	26	310
B	34	20
C	27	56
D & E	28 & 29	48 & 25
F & G	38 & 35	78 & 110
H & I	37 & 36	142 & 180
J & K	30 & 31	133 & 220
L & M	32 & 33	50 & 300
N & O	42 & 43	140 & 230
P & Q	39 & 41	60 & 310

○ Circled thermocouples are inserted inside the vapour space wall.

Number 44 represents pressure(vessel) in psig.
Number 45 represents time in seconds.
Reference upper diameter = 45.47 cms.

Thermocouple numbers.	Height (cm)	Angle with the vertical (Deg.)	Doubtful or faulty Thermocouple.
12	42.57	-	-
10	41.545	-	-
15	40.495	-	-
11	39.475	-	-
19	38.55	-	YES.
09	37.575	-	-
18	36.595	-	-
04	34.62	-	-
05	33.59	-	-
06	32.60	-	-
01	31.16	-	-
03	30.63	-	YES.
08	29.61	-	-
07	27.635	-	-
02	24.72	-	-
24	22.87	-	-
13	21.83	-	-
23	17.82	-	-
22	14.38	-	-
21	10.34	-	-
36	07.63	180	-
26	-	310	-
27 & 28	-	56 & 48	-
29 & 38	-	25 & 78	-
35 & 37	-	110 & 142	-
30 & 31	-	133 & 220	-
33 & 34	-	300 & 20	YES.
32 & 39	-	50 & 60	-
41 & 42	-	310 & 140	-
43	-	230	-
14	31.2	-	-
16	31.2	-	-
25	22.8	-	-
17	22.8	-	-
20 & 40	Reference Temperature	-	-

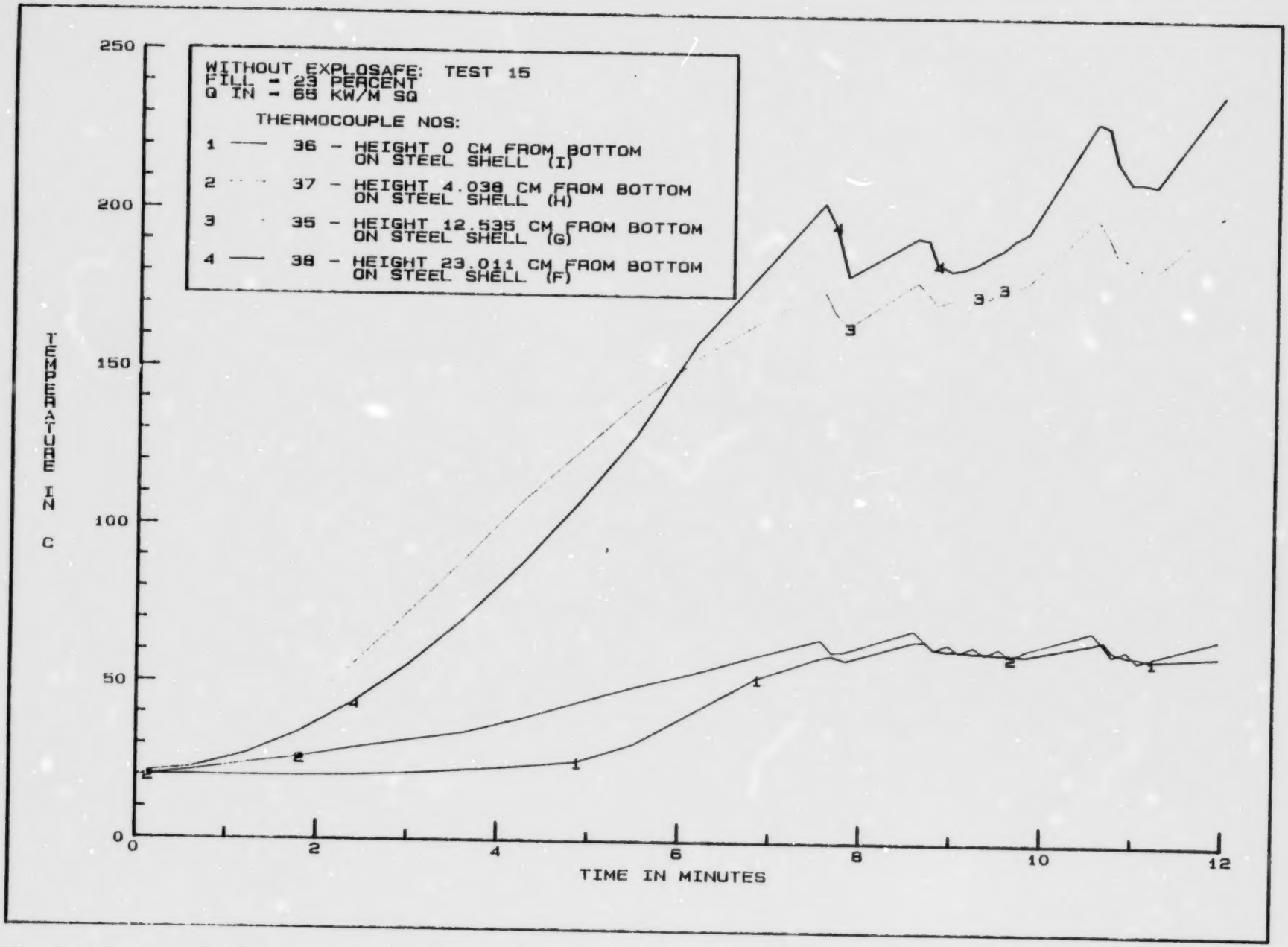
Fig. III.A A grid layout of thermocouples along with their locations for an unprotected vessel(UNB) with the PRV orifice of 1/4 in. (Valid for 76, 58 and 23 percent liquid full cases)

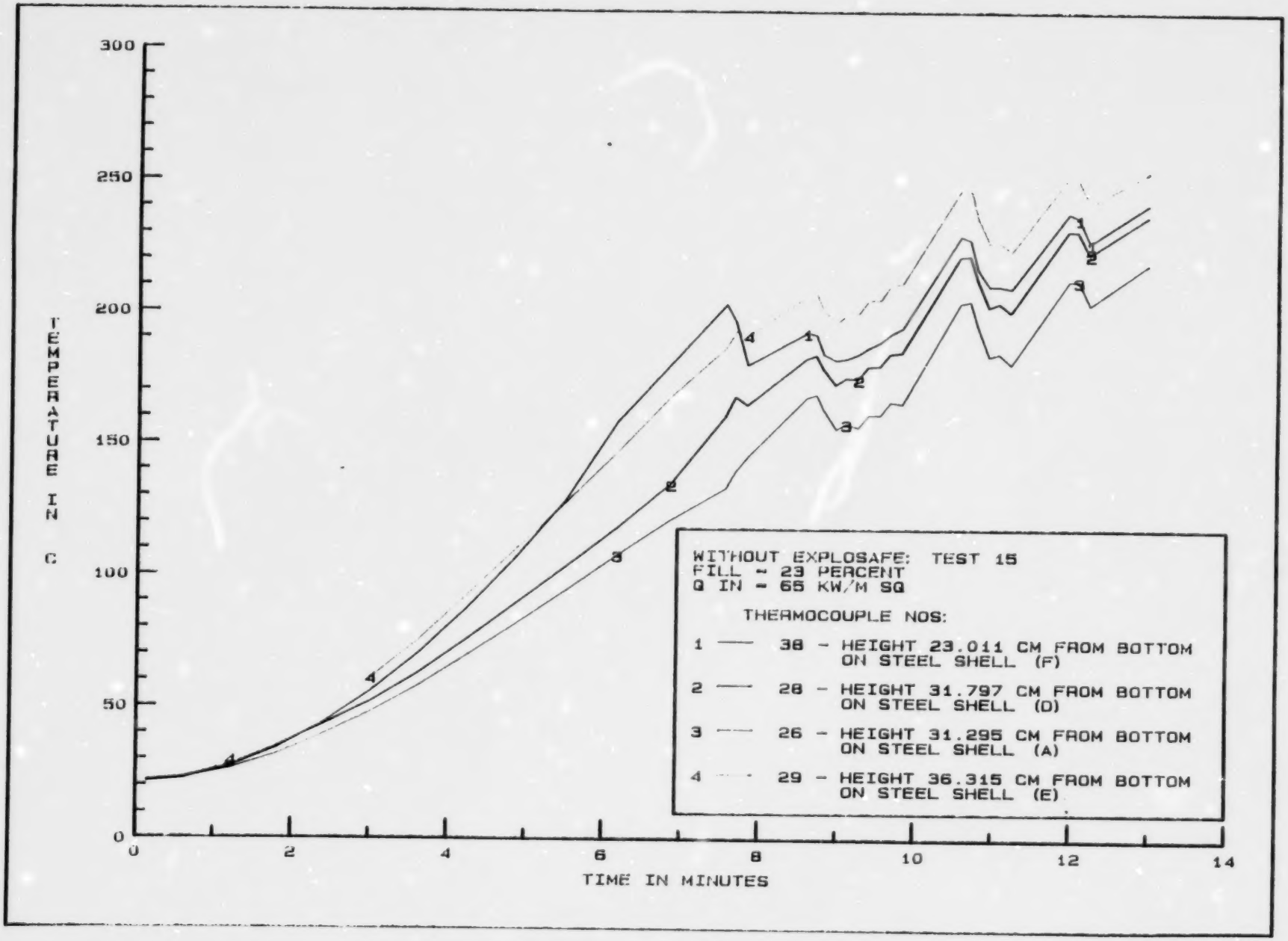
FOLLOWING THERMOCOUPLES ARE PLACED

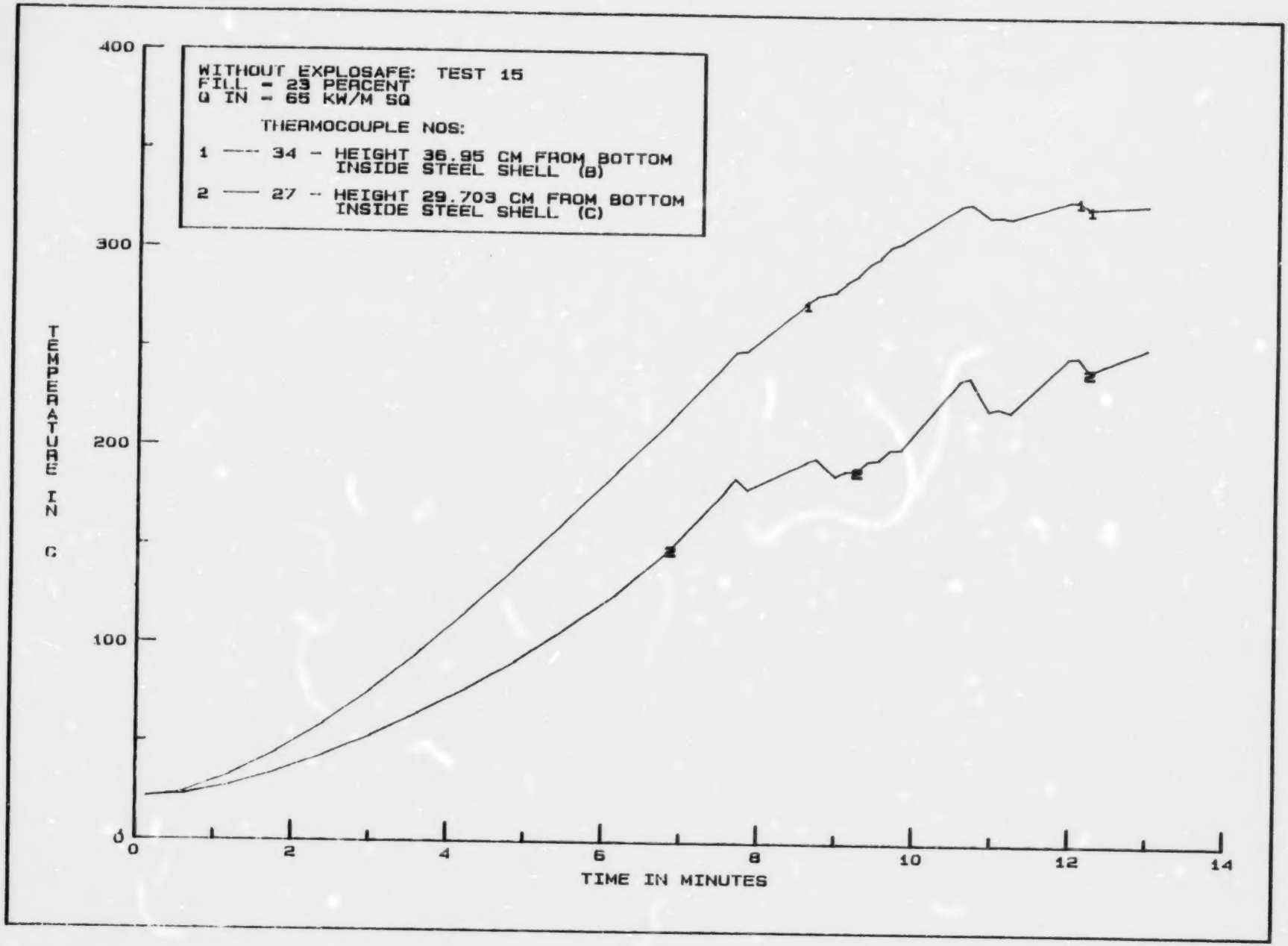
ON THE MILD STEEL SHELL OR

INSIDE THE MILD STEEL SHELL

THERMOCOUPLE NUM.	HEIGHT FROM BOTTOM IN CM
ON THE MILD STEEL SHELL:	
36 OR I	0
37 OR H	4.038
38 OR G	12.535
39 OR F	23.011
26 OR D	31.797
25 OR A	31.295
29 OR E	36.315
INSIDE THE MILD STEEL SHELL:	
34 OR B	36.95
27 OR C	29.703


WITHOUT EXPLOSAFE: TEST 15
FILL - 23 PERCENT
Q IN - 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 36 - HEIGHT 0 CM FROM BOTTOM ON STEEL SHELL (I)
2 - - - 37 - HEIGHT 4.038 CM FROM BOTTOM ON STEEL SHELL (H)
3 · · · 35 - HEIGHT 12.535 CM FROM BOTTOM ON STEEL SHELL (G)
4 —— 38 - HEIGHT 23.011 CM FROM BOTTOM ON STEEL SHELL (F)
TEMPERATURE IN C
250
200
150
100
50
0
0
2
4
6
8
10
12
TIME IN MINUTES


TEMPERATURE IN C
300
250
200
150
100
50
0
0
2
4
6
8
10
12
14
TIME IN MINUTES
WITHOUT EXPLOSAFE: TEST 15
FILL ~ 23 PERCENT
Q IN ~ 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 38 - HEIGHT 23.011 CM FROM BOTTOM ON STEEL SHELL (F)
2 —— 28 - HEIGHT 31.797 CM FROM BOTTOM ON STEEL SHELL (D)
3 —— 26 - HEIGHT 31.295 CM FROM BOTTOM ON STEEL SHELL (A)
4 —— 29 - HEIGHT 36.315 CM FROM BOTTOM ON STEEL SHELL (E)

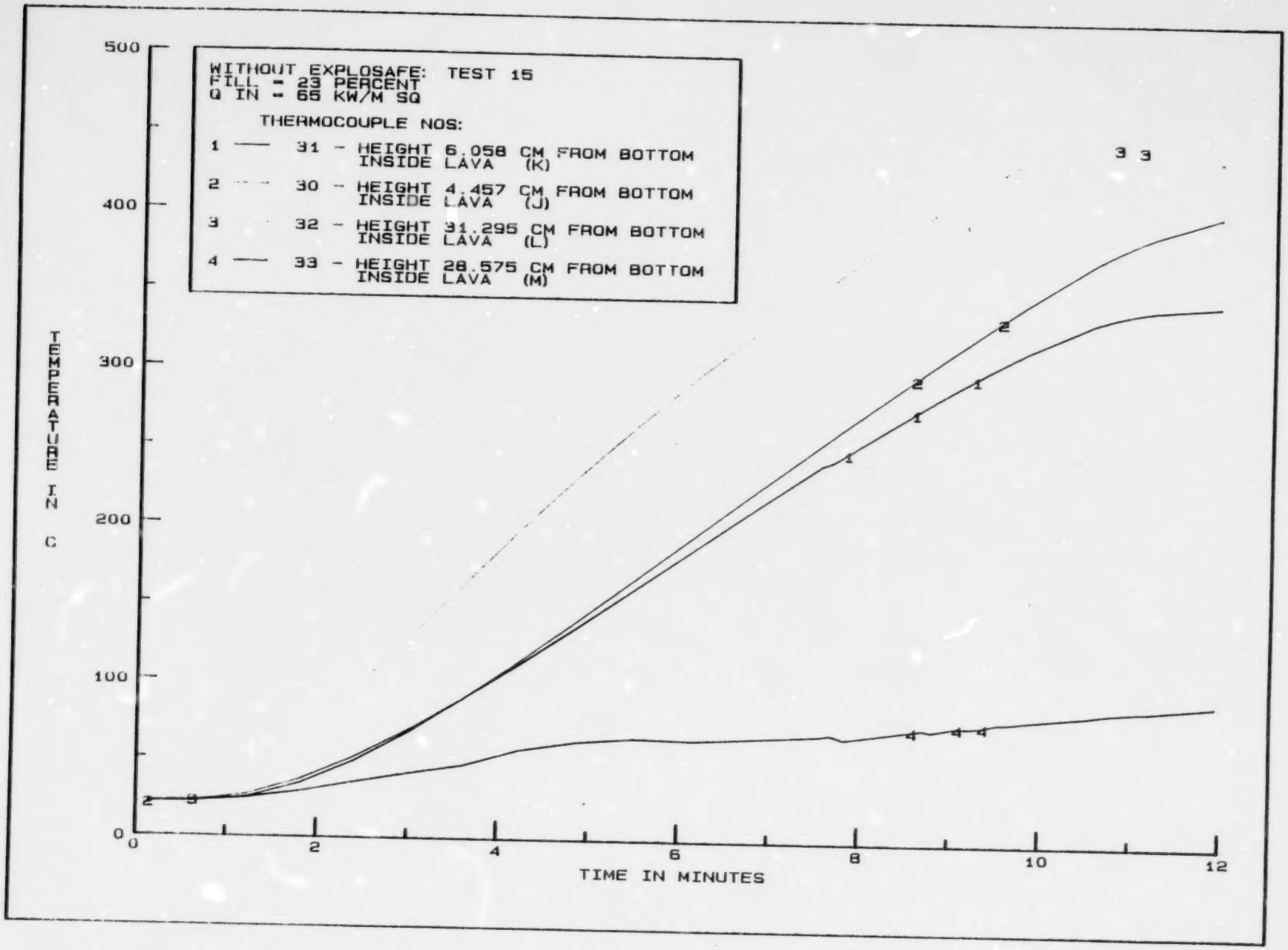

WITHOUT EXPLOSAFE: TEST 15
FILL - 23 PERCENT
Q IN - 65 KW/M SQ
THERMOCOUPLE NOS:
1 ---- 34 - HEIGHT 36.95 CM FROM BOTTOM INSIDE STEEL SHELL (B)
2 ---- 27 - HEIGHT 29.703 CM FROM BOTTOM INSIDE STEEL SHELL (C)
TEMPERATURE IN C
400
300
200
100
0
0
2
4
6
8
10
12
14
TIME IN MINUTES

FOLLOWING THERMOCOUPLES ARE PLACED

IN THE LAVA MEDIUM

THERMOCOUPLE NUM.	HEIGHT FROM BOTTOM IN CM
31 OR K	6.058
30 OR J	4.457
32 OR L	31.295
33 OR M	28.575

ALL FOUR PLOTS ARE GIVEN IN ONE PAGE

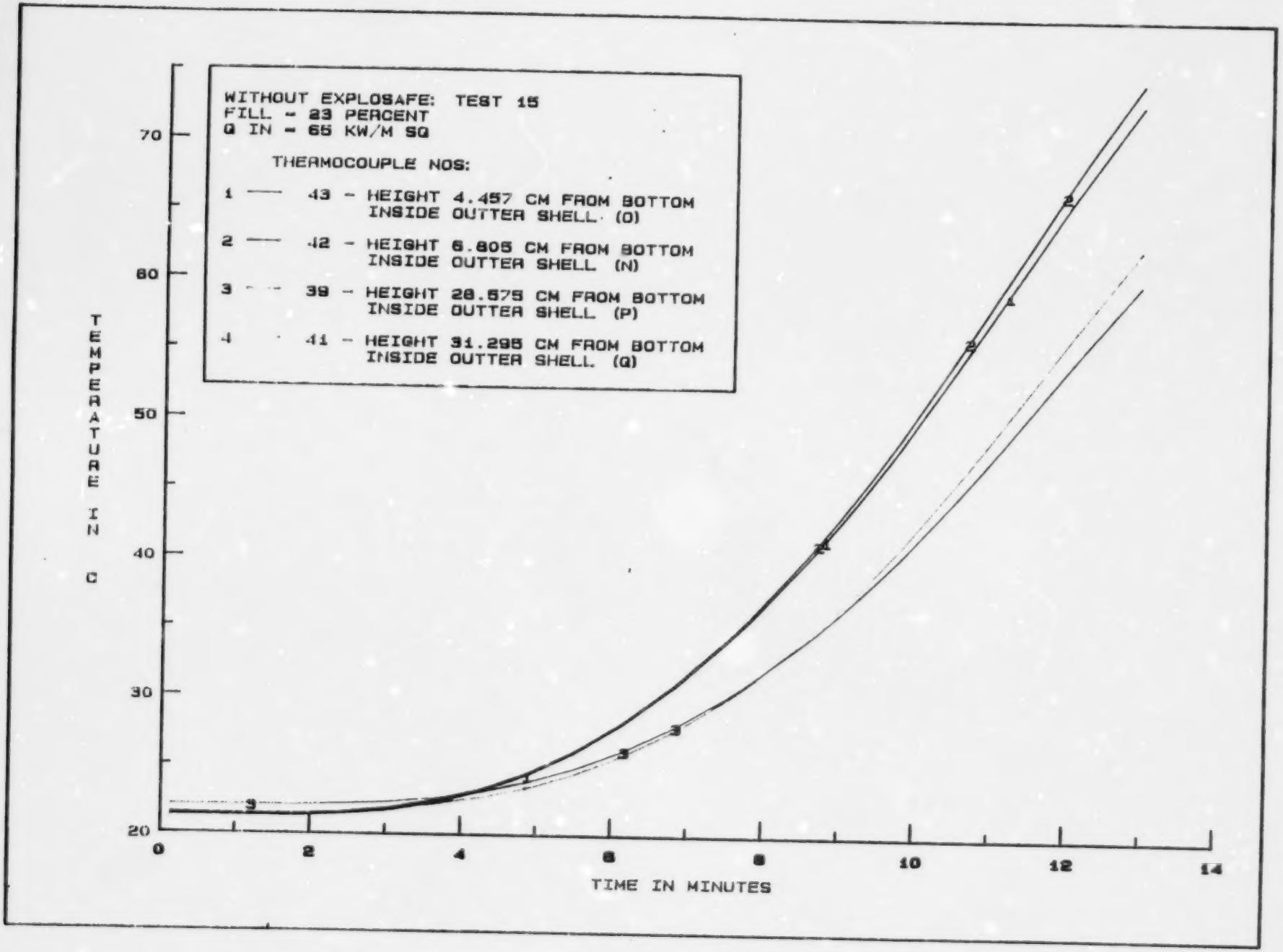

WITHOUT EXPLOSAFE: TEST 15
FILL = 23 PERCENT
Q IN = 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 31 - HEIGHT 6.058 CM FROM BOTTOM INSIDE LAVA (K)
2 - - - 30 - HEIGHT 4.457 CM FROM BOTTOM INSIDE LAVA (J)
3 32 - HEIGHT 31.295 CM FROM BOTTOM INSIDE LAVA (L)
4 —— 33 - HEIGHT 28.575 CM FROM BOTTOM INSIDE LAVA (M)
TEMPERATURE IN C
500
400
300
200
100
0
0
2
4
6
8
10
12
TIME IN MINUTES

FOLLOWING THERMOCOUPLES ARE PLACED

INSIDE THE OUTER SHELL

THERMOCOUPLE NUM.	HEIGHT FROM BOTTOM IN CM
42 CR N	6.805
43 CR O	4.457
41 CR O	31.295
39 CR P	28.575

ALL FOUR PLOTS ARE GIVEN IN ONE PAGE


WITHOUT EXPLOSAFE: TEST 15
FILL - 23 PERCENT
Q IN - 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 43 - HEIGHT 4.457 CM FROM BOTTOM INSIDE OUTTER SHELL (O)
2 —— 42 - HEIGHT 6.805 CM FROM BOTTOM INSIDE OUTTER SHELL (N)
3 - - 39 - HEIGHT 28.575 CM FROM BOTTOM INSIDE OUTTER SHELL (P)
4 · 41 - HEIGHT 31.295 CM FROM BOTTOM INSIDE OUTTER SHELL (Q)
TEMPERATURE IN C
70
60
50
40
30
20
0
2
4
6
8
10
12
14
TIME IN MINUTES

TEST 15

WITHOUT EXPLOSAFE

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITHOUT EXPLOSAFE - FILE NAME : TEST 15

DATE OF TEST : JAN 10, 1984 Q IN = 65 KW/M SQ LIQUID LEVEL = 23 PERCENT

SET PRESSURE = 35 PSIG PRV ORIFICE DIAMETER = 1/4 INCHES

	TIME MINS	PRESSURE PSIG	THRM#1 C	THRM#2 C	THRM#3 C	THRM#4 C	THRM#5 C	THRM#6 C	THRM#7 C	THRM#8 C	THRM#9 C	THRM#10 C	THRM#11 C
1.	0.139	3.386	20.894	20.943	*******	21.191	21.216	21.042	21.117	21.117	21.340	21.934	21.488
2.	0.630	4.490	21.608	21.682	*******	21.781	21.830	21.657	21.830	21.880	21.806	22.449	22.177
3.	1.213	5.655	22.209	22.308	*******	22.258	22.332	22.184	22.382	22.555	22.060	22.728	22.209
4.	1.804	6.836	22.782	22.880	*******	22.732	22.806	22.683	22.930	23.177	22.559	24.335	22.954
5.	2.403	8.082	23.422	23.670	*******	23.274	23.397	23.298	23.594	23.866	23.126	27.377	25.710
6.	3.012	9.577	24.400	24.744	*******	24.178	24.351	24.203	24.646	24.916	24.449	30.345	28.054
7.	3.618	11.425	25.788	27.650	*******	25.420	25.666	25.469	26.230	26.451	27.259	35.998	31.887
8.	4.244	13.754	27.832	45.449	*******	27.147	27.612	27.391	29.637	28.881	31.047	43.796	36.528
9.	4.868	16.877	30.857	46.724	*******	29.690	30.347	30.103	38.031	33.111	35.282	50.565	41.809
10.	5.504	20.594	36.244	49.047	*******	33.473	34.584	34.632	53.891	45.382	38.544	57.127	47.335
11.	6.164	25.295	46.487	48.483	*******	38.758	40.904	41.878	58.413	50.587	41.855	66.327	53.333
12.	6.850	31.138	53.562	63.237	*******	52.541	57.836	53.585	59.673	57.790	47.612	78.195	59.260
13.	7.557	38.245	73.537	75.589	*******	68.329	66.725	69.050	82.867	80.951	65.026	83.526	63.958
14.	7.683	30.004	81.182	76.600	*******	71.734	70.005	77.444	84.721	85.444	68.497	87.039	68.857
15.	7.835	33.132	78.232	68.509	*******	72.777	70.737	75.389	74.319	78.875	72.531	94.968	78.454
16.	8.587	43.036	95.789	84.834	*******	104.650	101.480	99.854	92.736	97.240	91.328	107.530	105.410
17.	8.713	35.564	100.400	86.332	*******	107.660	104.760	102.660	95.981	100.360	102.040	119.650	113.090
18.	8.808	32.053	98.028	82.369	*******	104.390	101.450	99.056	91.127	96.267	100.850	111.610	108.090
19.	8.964	36.930	87.942	73.243	*******	93.778	90.465	88.683	79.512	85.780	93.821	105.780	101.760
20.	9.092	31.044	88.452	73.207	*******	95.382	91.819	89.453	79.875	85.702	98.326	114.940	107.730
21.	9.248	36.024	85.886	69.336	*******	92.110	88.745	86.651	76.850	82.706	97.112	112.310	106.640
22.	9.376	30.214	88.884	71.816	*******	96.606	93.070	90.015	79.827	85.480	102.230	120.660	112.930
23.	9.531	35.345	87.588	69.176	*******	94.571	90.981	88.503	78.068	84.090	99.896	114.840	109.740
24.	9.660	29.338	91.422	72.574	*******	99.390	95.849	93.283	81.567	87.247	105.990	125.680	118.380
25.	9.815	34.335	90.022	69.623	*******	97.493	93.704	91.281	79.813	85.662	103.650	120.110	113.730
26.	10.560	43.384	132.620	106.030	*******	140.110	135.630	133.560	118.450	126.950	147.170	172.190	160.840
27.	10.688	34.249	136.490	110.090	*******	143.740	139.670	137.160	121.980	130.970	150.230	170.410	161.160
28.	10.784	29.974	130.850	103.530	*******	137.570	133.160	130.610	114.500	124.470	142.000	160.310	148.600
29.	10.936	35.173	112.640	86.407	*******	120.610	115.410	112.980	95.861	106.620	125.470	133.130	132.800
30.	11.061	27.593	110.880	85.713	*******	119.930	114.620	111.790	96.018	105.160	125.900	141.300	135.920
31.	11.214	32.367	105.150	79.786	*******	113.600	108.740	106.290	91.363	99.546	120.080	134.470	130.120
32.	11.949	39.942	141.570	113.240	*******	149.710	145.670	143.160	126.510	135.560	158.280	181.060	167.350
33.	12.075	30.240	144.740	116.990	*******	153.300	148.520	145.580	129.780	138.870	160.640	180.280	168.880
34.	12.227	34.799	134.310	105.070	*******	142.970	137.950	135.010	117.660	128.200	148.730	161.880	155.830
35.	12.966	41.957	149.480	121.350	*******	159.160	154.370	151.350	134.430	144.050	166.360	190.420	179.610

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITHOUT EXPLOSAFE - FILE NAME : TEST 15

DATE OF TEST : JAN 10, 1984 Q IN = 65 KW/M SQ LIQUID LEVEL = 23 PERCENT

SET PRESSURE = 35 PSIG PRV ORIFICE DIAMETER = 1/4 INCHES

	TIME MINS	PRESSURE PSIG	THRM#12 C	THRM#13 C	THRM#14 C	THRM#15 C	THRM#16 C	THRM#17 C	THRM#18 C	THRM#19 C	THRM#20 C	THRM#21 C	THRM#22 C
1.	0.139	3.386	22.330	20.795	20.819	21.687	20.323	20.894	21.117	832.440	2.322	18.258	18.383
2.	0.630	4.490	22.844	21.286	22.325	22.300	21.434	22.053	21.608	850.250	2.331	18.403	18.528
3.	1.213	5.655	23.049	21.788	23.863	22.357	22.530	23.197	21.862	861.550	2.342	18.884	19.580
4.	1.804	6.836	24.729	22.207	25.294	23.769	23.621	24.335	22.287	880.720	2.352	19.734	21.322
5.	2.403	8.082	28.306	22.953	26.912	26.691	24.826	25.759	22.829	942.660	2.362	21.469	23.619
6.	3.012	9.577	31.972	24.252	29.055	29.396	26.341	29.250	23.735	*******	2.371	23.907	27.174
7.	3.618	11.425	38.315	27.357	31.984	35.629	28.286	35.172	25.248	*******	2.380	27.870	31.232
8.	4.244	13.754	46.532	32.809	36.288	41.021	31.072	42.825	27.758	*******	2.388	34.604	36.744
9.	4.868	16.877	53.914	36.220	42.284	46.559	34.849	44.438	31.367	*******	2.396	40.453	41.286
10.	5.504	20.594	61.828	41.856	49.912	52.475	40.787	51.614	33.908	*******	2.403	45.476	45.995
11.	6.164	25.295	71.061	50.330	63.126	59.423	50.400	57.079	38.758	*******	2.410	50.540	51.333
12.	6.850	31.138	82.236	62.553	89.585	69.598	71.013	69.057	46.955	*******	2.417	56.223	56.869
13.	7.557	38.245	89.165	71.231	110.700	79.112	87.095	79.759	62.979	*******	2.424	61.953	62.888
14.	7.683	30.004	93.791	71.263	115.800	78.973	93.273	80.123	67.684	*******	2.425	61.164	61.255
15.	7.835	33.132	103.590	64.095	105.250	86.222	89.666	73.359	63.867	*******	2.427	59.001	59.689
16.	8.587	43.036	120.860	73.573	112.200	107.610	114.610	84.001	92.130	*******	2.433	65.470	66.399
17.	8.713	35.564	128.310	76.813	114.600	117.000	118.150	85.654	97.550	*******	2.434	65.163	65.571
18.	8.808	32.053	113.900	70.610	109.680	109.270	113.330	80.120	95.966	*******	2.435	62.166	62.486
19.	8.964	36.930	109.370	66.563	100.710	105.390	104.420	73.645	90.509	*******	2.436	61.264	62.132
20.	9.092	31.044	118.880	66.730	100.020	111.760	104.020	73.162	94.951	*******	2.437	61.456	61.685
21.	9.248	36.024	114.780	64.973	95.995	110.800	99.941	70.460	92.954	*******	2.438	60.254	61.375
22.	9.376	30.214	124.940	66.138	97.786	117.320	101.980	71.592	98.537	*******	2.439	60.790	60.927
23.	9.531	35.345	117.450	64.448	95.777	113.730	99.789	69.288	96.659	*******	2.440	59.679	60.801
24.	9.660	29.338	129.010	66.407	98.619	123.000	103.040	71.095	101.800	*******	2.441	60.283	60.329
25.	9.815	34.335	123.460	64.899	97.257	118.760	101.260	69.060	100.210	*******	2.442	58.873	60.042
26.	10.560	43.384	176.450	94.557	135.920	168.490	141.660	99.490	142.850	*******	2.448	66.127	67.303
27.	10.688	34.249	173.530	97.396	140.660	166.390	145.990	103.250	145.170	*******	2.448	65.250	65.182
28.	10.784	29.974	147.720	86.944	135.320	149.190	139.860	95.960	135.890	*******	2.449	61.544	61.475
29.	10.936	35.173	132.270	76.689	122.430	134.720	126.330	84.897	120.980	*******	2.450	59.149	61.096
30.	11.061	27.593	142.590	76.095	120.950	139.200	124.710	83.521	121.380	*******	2.451	59.637	59.339
31.	11.214	32.367	135.670	71.213	114.480	134.040	118.400	78.525	116.130	*******	2.452	57.488	59.923
32.	11.949	39.942	185.740	101.420	145.450	176.320	151.860	106.650	153.970	*******	2.456	63.935	66.295
33.	12.075	30.240	183.160	103.920	149.280	175.130	155.010	109.930	155.480	*******	2.457	62.965	62.053
34.	12.227	34.799	161.680	88.723	140.680	160.780	146.290	98.185	144.100	*******	2.458	59.658	62.083
35.	12.966	41.957	193.130	108.810	155.780	187.270	161.740	115.240	162.600	*******	2.462	65.194	72.540

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITHOUT EXPLOSAFE - FILE NAME : TEST 15

DATE OF TEST : JAN 18, 1984 Q IN = 65 KW/M SQ LIQUID LEVEL = 23 PERCENT

SET PRESSURE = 35 PSIG PRV ORIFICE DIAMETER = 1/4 INCHES

	TIME MINS	PRESSURE PSIG	THRM#23 C	THRM#24 C	THRM#25 C	THRM#26 C	THRM#27 C	THRM#28 C	THRM#29 C	THRM#30 C	THRM#31 C	THRM#32 C	THRM#33 C
1.	0.139	3.386	19.254	19.155	19.404	21.828	21.440	21.595	22.022	21.421	21.266	21.343	21.905
2.	0.630	4.490	19.996	19.946	20.864	22.768	22.923	23.001	23.775	21.547	22.129	23.059	22.362
3.	1.213	5.655	20.748	20.698	22.407	26.259	27.706	27.629	29.767	24.559	26.549	37.973	24.578
4.	1.804	6.836	21.570	21.421	23.966	31.723	34.716	34.677	38.083	33.757	36.611	63.904	29.098
5.	2.403	8.082	22.656	22.310	27.744	39.333	43.277	42.877	48.252	48.498	51.280	94.340	35.376
6.	3.012	9.577	25.113	24.744	38.665	47.941	53.277	51.765	61.035	67.483	69.241	128.030	41.423
7.	3.618	11.425	29.237	30.357	49.033	57.852	64.800	62.494	75.465	89.286	89.564	162.380	46.874
8.	4.244	13.754	35.374	37.200	60.422	69.549	77.285	75.498	92.737	113.930	112.150	198.060	57.751
9.	4.868	16.877	41.548	41.239	48.789	81.537	91.165	89.095	110.220	139.680	135.850	231.500	62.712
10.	5.504	20.594	47.006	41.167	52.731	94.191	107.780	103.080	127.930	166.690	160.740	263.680	65.504
11.	6.164	25.295	52.427	47.521	64.922	107.730	125.830	117.890	146.920	194.840	186.660	295.630	64.209
12.	6.850	31.138	58.273	59.788	74.526	121.190	148.790	134.620	168.170	224.090	213.470	325.840	66.586
13.	7.557	38.245	67.290	70.377	81.569	133.350	170.590	150.590	186.960	253.820	240.650	353.650	68.661
14.	7.683	30.004	66.848	69.510	80.895	139.730	184.850	167.920	193.000	259.070	243.160	359.020	69.746
15.	7.835	33.132	64.117	64.299	74.207	145.200	178.990	164.570	191.340	265.360	248.440	365.580	66.585
16.	8.587	43.036	67.327	78.534	85.184	167.680	193.380	182.380	206.790	296.140	275.110	394.800	72.975
17.	8.713	35.564	64.936	79.385	85.544	168.910	195.450	183.810	207.430	301.230	279.420	399.260	73.740
18.	8.808	32.063	61.915	72.516	80.231	162.710	191.670	178.370	200.910	305.080	282.700	402.960	72.471
19.	8.964	36.930	63.340	68.663	75.585	155.620	186.440	172.430	196.210	311.300	287.900	408.260	74.336
20.	9.092	31.044	61.090	68.379	74.101	157.860	189.000	175.160	199.540	316.410	292.110	412.710	75.526
21.	9.248	36.024	62.699	66.808	71.336	156.210	189.380	174.760	199.990	322.560	297.020	418.420	75.117
22.	9.376	30.214	62.731	67.325	71.547	161.170	193.960	179.390	205.130	327.610	301.180	422.970	76.180
23.	9.531	35.345	62.970	66.444	70.031	161.190	194.980	179.670	205.200	333.690	305.930	428.010	78.170
24.	9.660	29.338	63.456	68.057	70.623	166.020	199.850	184.350	211.040	338.670	309.810	432.390	78.524
25.	9.815	34.335	63.376	67.051	68.722	165.280	200.410	184.890	211.580	344.630	314.500	437.560	79.471
26.	10.560	43.384	81.251	100.730	104.820	203.710	235.240	221.380	247.380	371.330	333.210	446.740	83.614
27.	10.688	34.249	80.971	102.250	106.600	204.480	237.060	221.700	246.390	375.290	335.400	446.610	84.652
28.	10.784	29.974	74.900	90.970	95.766	195.040	230.180	212.680	235.950	378.050	336.940	446.320	85.377
29.	10.936	35.173	71.107	81.006	85.313	183.420	220.120	202.130	226.690	382.200	339.000	445.620	86.007
30.	11.061	27.593	69.945	79.444	82.862	184.530	221.590	203.840	227.140	385.360	340.470	444.860	86.655
31.	11.214	32.367	67.250	74.725	78.082	180.390	219.310	200.220	223.740	388.910	341.850	443.770	86.989
32.	11.949	39.942	86.898	107.850	109.920	212.360	247.290	231.450	252.640	402.100	345.400	436.830	90.838
33.	12.075	30.240	85.792	109.280	112.200	212.490	247.910	230.910	250.380	403.770	345.440	435.500	91.782
34.	12.227	34.799	78.823	94.595	98.571	203.160	240.330	222.450	242.020	405.600	345.400	433.690	93.075
35.	12.966	41.957	93.942	116.340	118.720	218.780	252.360	236.950	253.840	411.940	343.820	424.870	98.186

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITHOUT EXPLOSAFE - FILE NAME : TEST 15

DATE OF TEST : JAN 10, 1984 Q IN = 65 KW/M SQ LIQUID LEVEL = 23 PERCENT

SET PRESSURE = 35 PSIG PRV ORIFICE DIAMETER = 1/4 INCHES

	TIME MINS	PRESSURE PSIG	THRM034 C	THRM035 C	THRM036 C	THRM037 C	THRM038 C	THRM039 C	THRM040 C	THRM041 C	THRM042 C	THRM043 C
1.	0.139	3.386	21.479	20.955	19.965	19.946	21.110	22.022	2.475	21.731	21.440	21.304
2.	0.630	4.490	24.239	23.814	19.975	21.392	22.497	22.032	2.474	21.722	21.412	21.315
3.	1.213	5.655	33.110	31.247	19.966	25.082	27.012	22.062	2.473	21.732	21.403	21.306
4.	1.804	6.836	44.865	41.536	20.039	28.946	34.064	22.057	2.471	21.708	21.437	21.320
5.	2.403	8.082	59.351	55.868	20.456	28.982	43.657	22.163	2.472	21.795	21.581	21.465
6.	3.012	9.577	76.402	72.452	21.090	31.552	55.804	22.311	2.471	21.923	21.685	21.749
7.	3.618	11.425	95.213	89.305	22.228	34.041	70.206	22.615	2.470	22.228	22.460	22.305
8.	4.244	13.754	116.410	107.370	23.502	38.533	87.507	23.095	2.470	22.727	23.289	23.153
9.	4.868	16.877	138.760	123.170	25.123	43.828	106.870	23.828	2.470	23.441	24.505	24.369
10.	5.504	20.594	162.500	139.240	30.962	48.970	126.690	24.832	2.470	24.484	26.107	26.011
11.	6.164	25.295	187.560	153.430	41.464	53.619	158.190	26.182	2.469	25.892	28.265	28.168
12.	6.850	31.138	213.860	165.190	52.277	59.251	180.200	27.955	2.469	27.724	31.035	30.900
13.	7.557	38.245	243.180	175.610	59.099	64.674	203.130	30.206	2.469	30.110	34.410	34.276
14.	7.683	30.004	248.720	168.170	59.570	60.434	196.170	30.649	2.469	30.572	35.063	34.929
15.	7.835	33.132	249.660	164.050	58.046	61.054	179.870	31.207	2.469	31.168	35.867	35.714
16.	8.587	43.036	273.850	178.250	64.395	67.990	192.370	34.240	2.469	34.508	40.376	40.090
17.	8.713	35.564	277.730	174.620	64.507	64.526	191.470	34.796	2.469	35.121	41.196	40.891
18.	8.808	32.053	278.570	171.010	62.012	61.749	184.060	35.254	2.469	35.580	41.805	41.600
19.	8.964	36.930	280.040	172.810	61.356	63.551	181.770	35.964	2.469	36.365	42.815	42.472
20.	9.092	31.044	284.510	171.750	61.579	60.941	182.560	36.593	2.469	37.052	43.707	43.326
21.	9.248	36.024	288.430	174.380	60.791	62.913	184.290	37.359	2.469	37.856	44.772	44.354
22.	9.376	30.214	293.610	173.190	60.961	60.341	186.640	38.010	2.469	38.583	45.685	45.248
23.	9.531	35.345	297.450	176.910	60.435	62.445	188.820	38.793	2.469	39.461	46.805	46.330
24.	9.660	29.338	302.780	176.390	60.718	59.628	191.920	39.481	2.469	40.225	47.773	47.242
25.	9.815	34.335	305.220	178.430	59.966	61.806	194.350	40.300	2.469	41.101	48.928	48.379
26.	10.560	43.384	323.940	199.010	64.230	67.993	229.320	44.663	2.470	45.917	54.924	54.150
27.	10.688	34.249	324.990	193.290	65.092	63.912	227.660	45.461	2.470	46.771	55.998	55.169
28.	10.784	29.974	322.440	187.020	61.701	60.329	216.520	46.053	2.470	47.419	56.755	55.926
29.	10.936	35.173	317.970	185.200	60.329	62.207	210.000	46.982	2.470	48.423	57.997	57.094
30.	11.061	27.593	318.770	182.690	59.991	58.506	210.290	47.798	2.470	49.314	59.089	58.129
31.	11.214	32.367	317.560	181.830	58.977	59.992	209.300	48.765	2.470	50.375	60.349	59.353
32.	11.949	39.942	326.730	199.930	60.408	65.661	238.180	53.647	2.470	55.628	66.560	65.324
33.	12.075	30.240	325.770	194.860	62.476	60.843	236.310	54.461	2.471	56.535	67.609	66.318
34.	12.227	34.799	322.810	187.530	60.580	62.139	226.980	55.424	2.471	57.571	68.844	67.461
35.	12.966	41.957	325.020	200.140	61.487	67.035	241.520	60.097	2.471	62.651	74.559	73.012

PLOTS OF A TEST

CARRIED OUT ON THE UNB TANK 2

WITHOUT EXPLOSAFE

TEST NUMBER 16

Q in = 65 kW/m sq

LIQUID LEVEL = 76 %

SET PRESSURE = 35 psig

PRV ORIFICE DIAMETER = 3/8 in.

Date of Test FEB 01, 1984

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1. For the Thermocouples Placed in a Vertical Line:
   (a) Plots of Temperature Vs Time - - - - - - -
   (b) Plots of Height Vs. Temperature - - - - - -

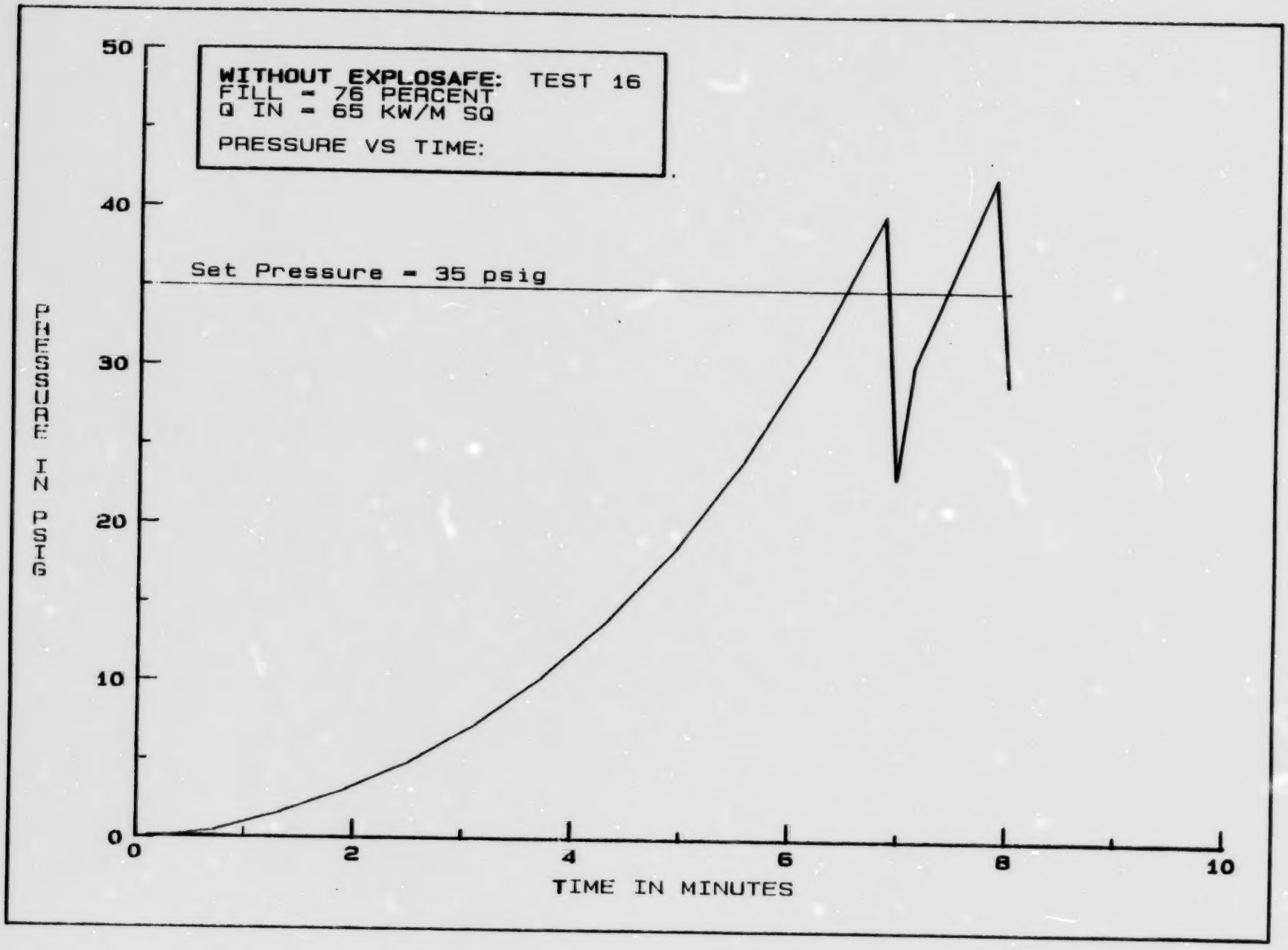
2. Thermocouples Placed in the Four Quadrants
   in a Vertical Plane: Temp. Vs. Time - - - - -

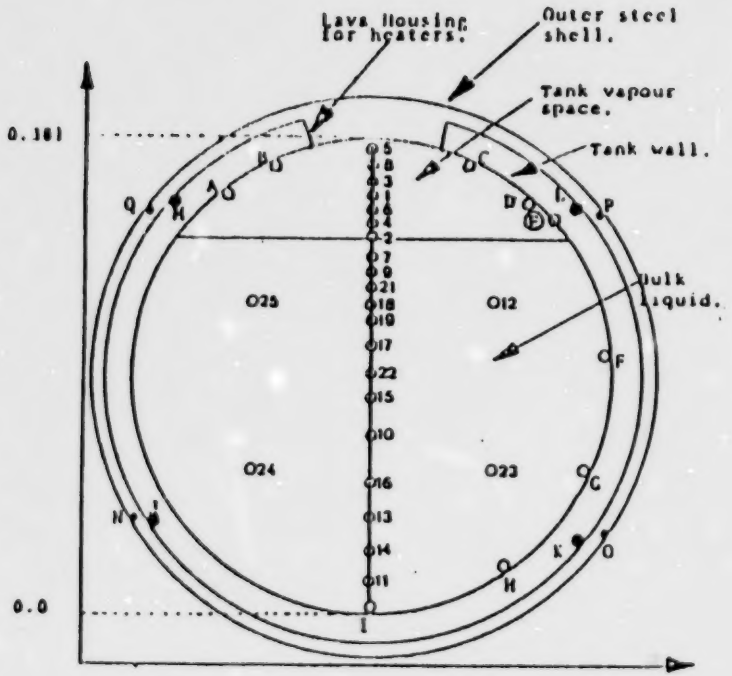
Thermocouple Grid Layout - - - - - - - - - - -

3. Thermocouples Placed On and Inside the
   Mild Steel Shell: Temp. Vs. Time - - - - - -

4. Thermocouples Placed in the Lava Medium
   Temp. Vs. Time - - - - - - - - - - - - - -

6. Print out of Data - - - - - - - - - - - -


WITHOUT EXPLOSAFE: TEST 16
FILL = 76 PERCENT
Q IN = 65 KW/M SQ
PRESSURE VS TIME:
Set Pressure = 35 psig
PRESSURE IN PSIG
50
40
30
20
10
0
0
2
4
6
8
10
TIME IN MINUTES



SYMBOL	Thermocouple #	Angle(Deg)
A	28	310
B & C	37 & 29	340 & 22
D & E	36 & 34	55 & 56
F & G	27 & 38	92 & 116
H & I	35 & 26	144 & 180
J & K	30 & 31	133 & 220
L & M	32 & 33	50 & 300
N & O	42 & 43	140 & 230
P & Q	39 & 41	60 & 310

○ Circled thermocouple is inserted inside the vapour space wall.

Number 45 represents time in seconds.
Number 44 represents pressure in psig.
Reference upper diameter = 48.37 cms.

Thermocouple numbers.	Height (cm)	Angle with the vertical (Deg.)	Doubtful or faulty Thermocouple.
05	45.08	-	-
08	44.905	-	-
03	43.63	-	YES
01	42.715	-	-
06	41.805	-	-
04	40.745	-	-
02	39.885	-	-
07	37.765	-	-
09	36.845	-	-
21	35.705	-	-
18	34.84	-	-
19	33.86	-	YES
17	31.72	-	-
22	29.635	-	-
15	27.665	-	-
10	25.585	-	-
16	24.585	-	-
13	21.02	-	-
14	16.94	-	-
11	12.81	-	-
26	10.255	180	-
29 & 36	-	22 & 55	-
28 & 37	-	310 & 340	-
27 & 38	-	92 & 116	-
35	-	144	-
30 & 31	-	133 & 220	-
32 & 33	-	50 & 300	-
39 & 41	-	60 & 310	-
42 & 43	-	140 & 230	-
34	-	56	YES
23 & 25	-	-	YES
12	32.20	-	-
24	24.85	-	-
20 & 40	Reference temperature	-	-

Fig. III.B A grid layout of thermocouples along with their locations for an unprotected vessel(UNB) with the PRV orifice of 3/8 in. (Valid for 76, 58 and 23 percent liquid full cases)

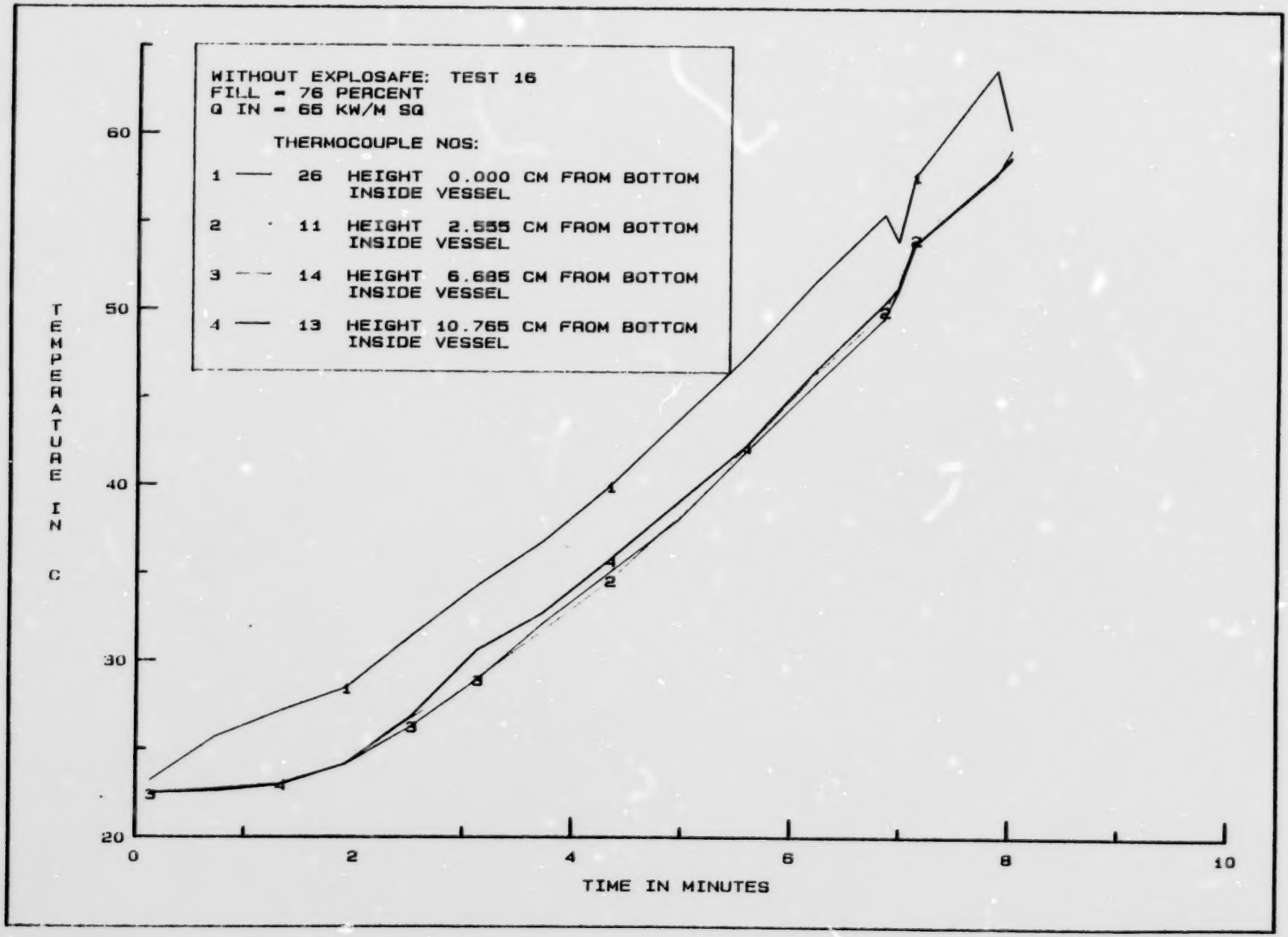
FOLLOWING THERMOCOUPLES ARE PLACED

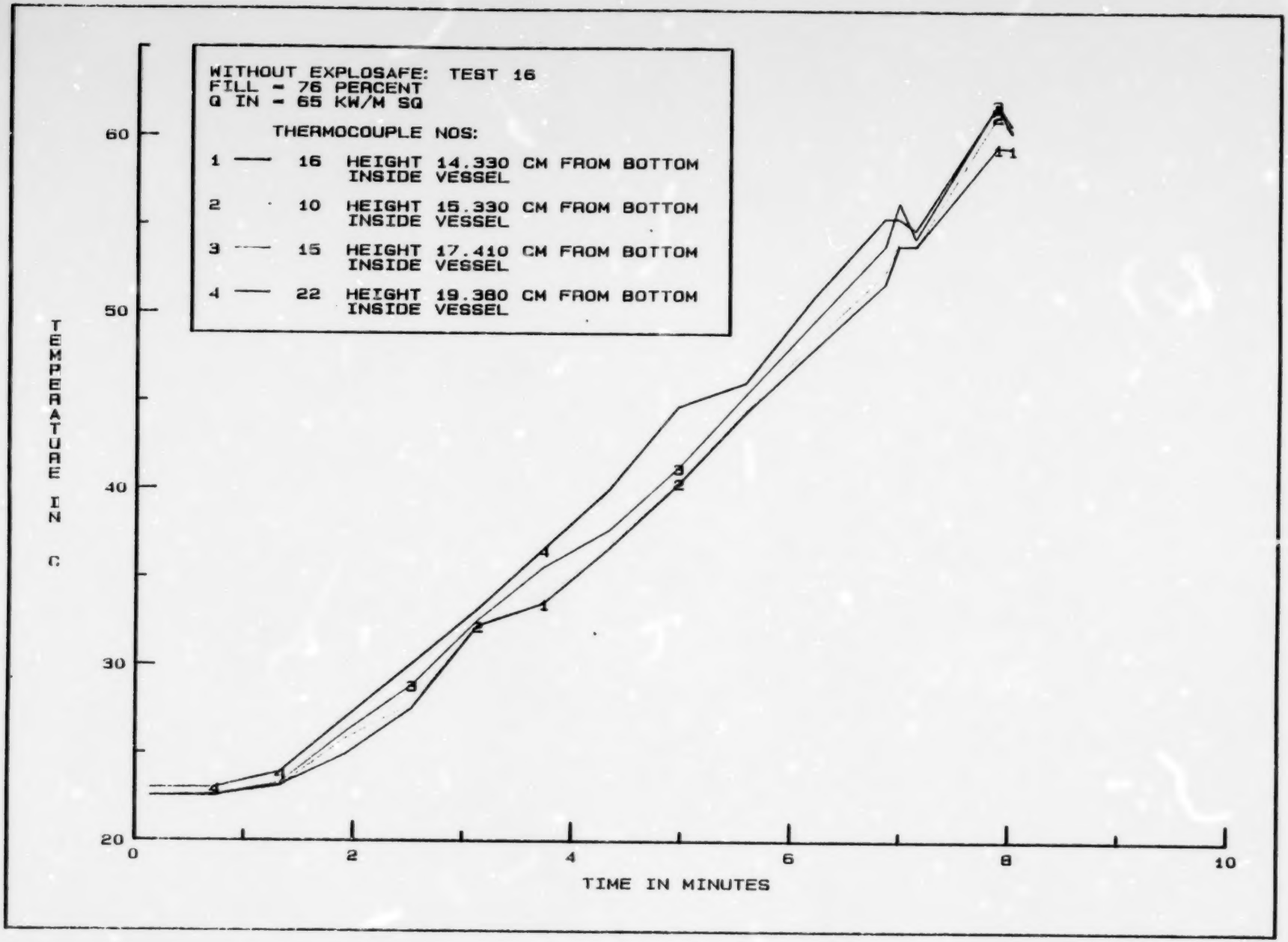
AT THE CENTRE OF THE VESSEL (DIA. 38.1 CM)

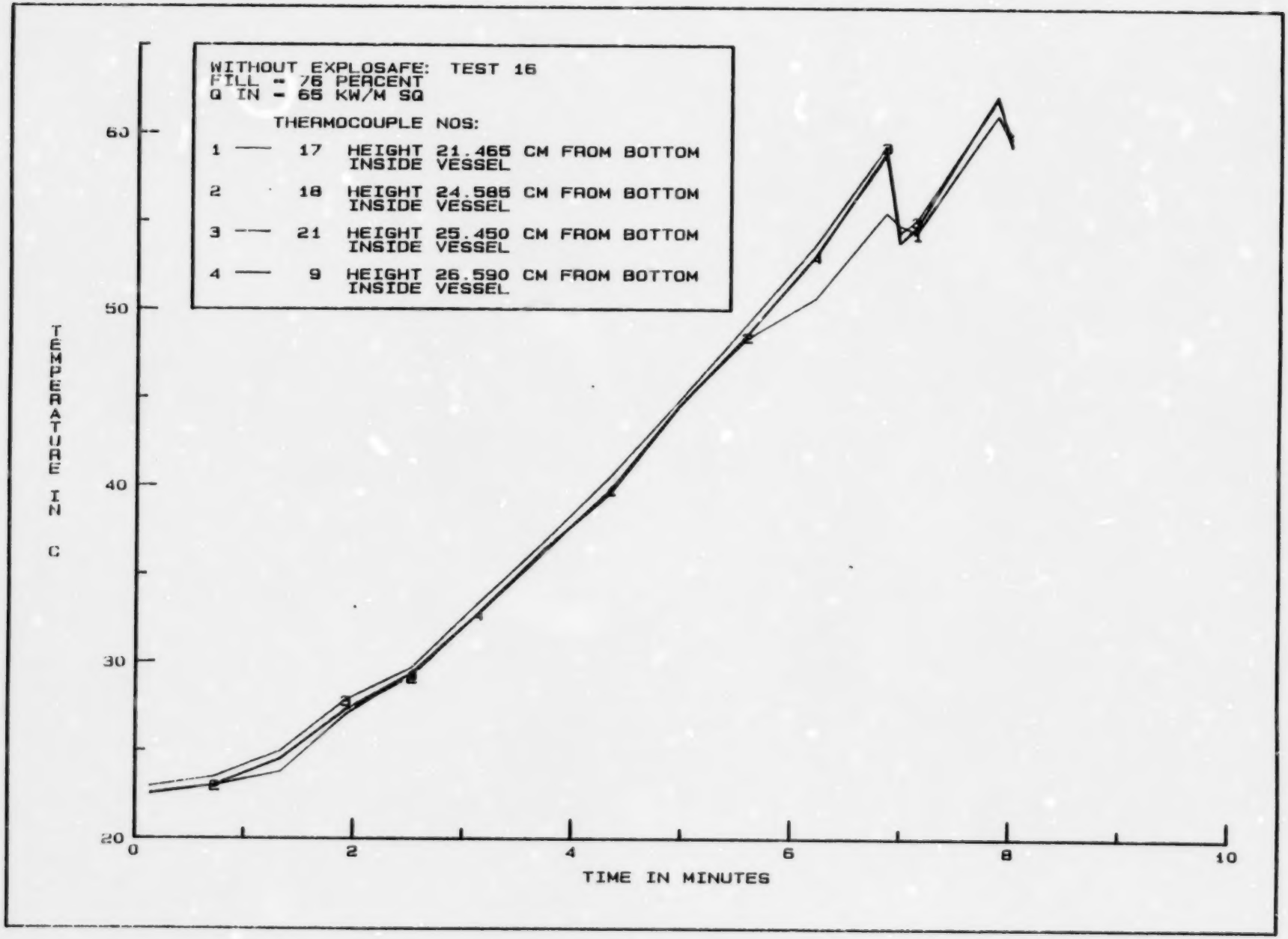
IN A VERTICLE AXIS

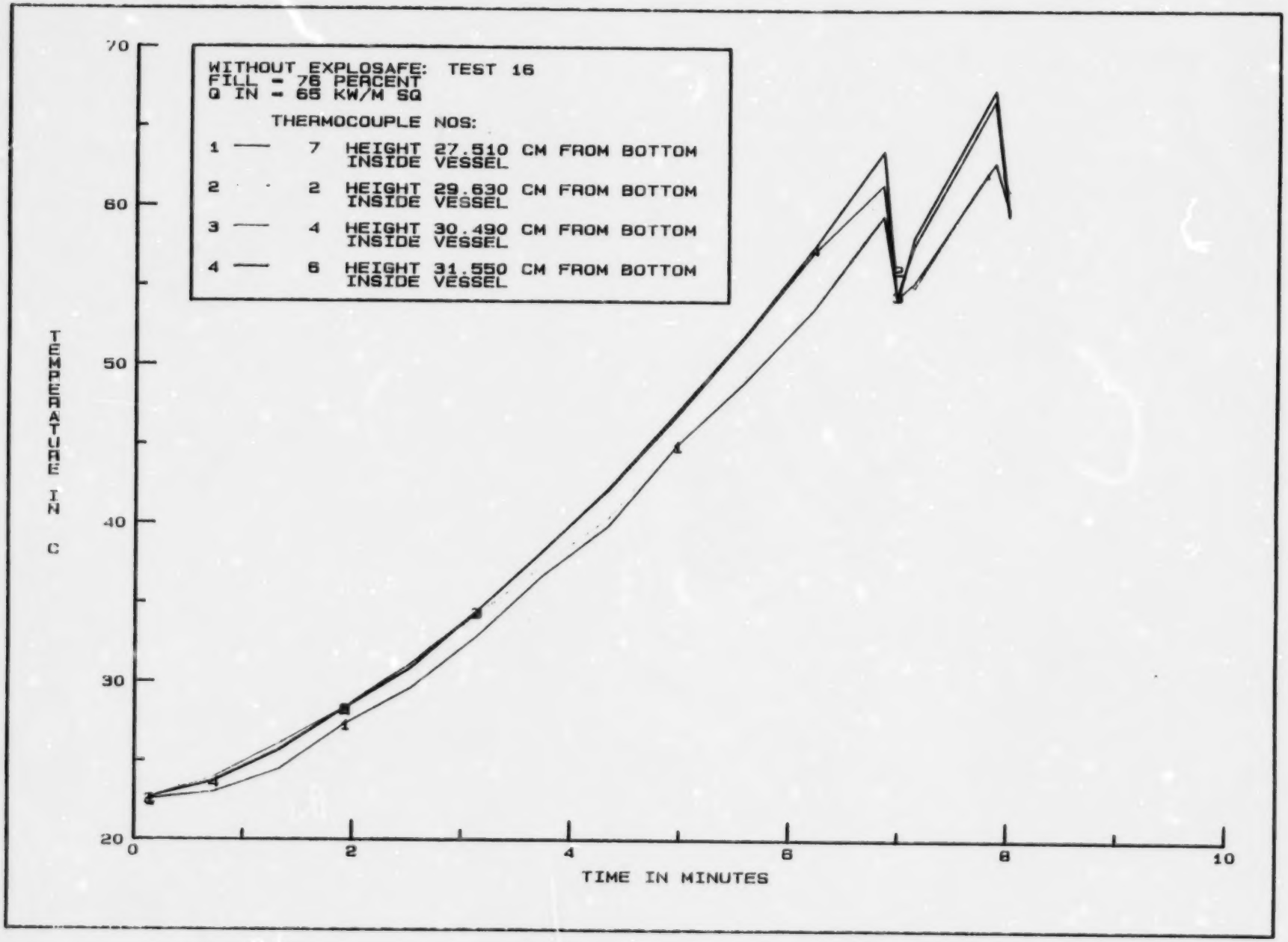
THERMOCOUPLE NUM.	HEIGHT FROM BOTTOM IN cm
26 OR I	0
11	2.555
14	6.685
13	10.765
16	14.33
10	15.33
15	17.41
22	19.38
17	21.465
18	24.585
21	25.45
9	26.59
7	27.51
2	29.63
4	30.49
6	31.55
1	32.46
8	34.65
5	35.625

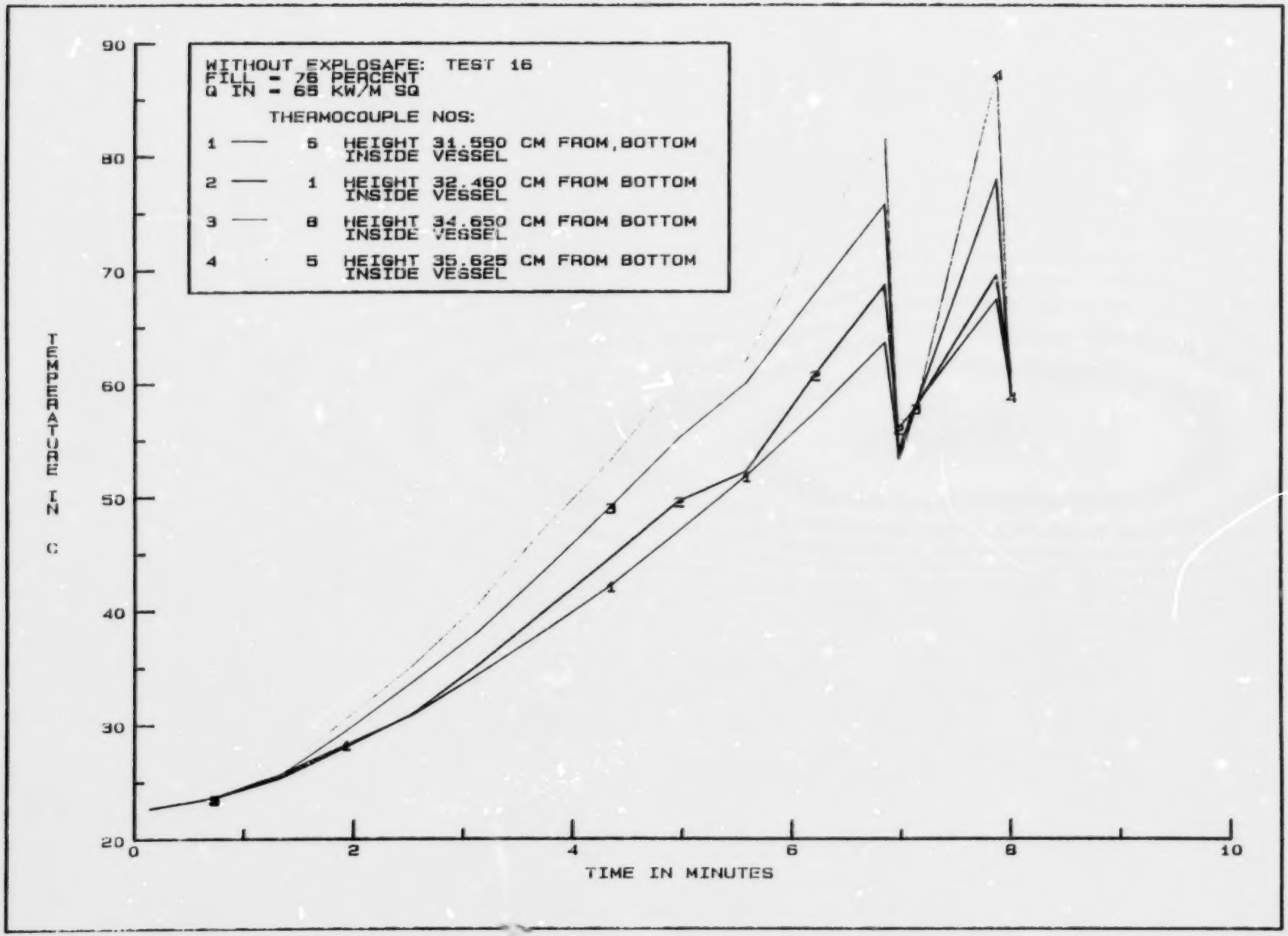
PLOTS ARE GIVEN PER PAGE


WITHOUT EXPLOSAFE: TEST 16
FILL = 76 PERCENT
Q IN = 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 26 HEIGHT 0.000 CM FROM BOTTOM INSIDE VESSEL
2 · 11 HEIGHT 2.555 CM FROM BOTTOM INSIDE VESSEL
3 — 14 HEIGHT 6.685 CM FROM BOTTOM INSIDE VESSEL
4 —— 13 HEIGHT 10.765 CM FROM BOTTOM INSIDE VESSEL
TEMPERATURE IN C
60
50
40
30
20
0
2
4
6
8
10
TIME IN MINUTES


WITHOUT EXPLOSAFE: TEST 16
FILL - 76 PERCENT
Q IN - 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 16 HEIGHT 14.330 CM FROM BOTTOM INSIDE VESSEL
2 10 HEIGHT 15.330 CM FROM BOTTOM INSIDE VESSEL
3 —— 15 HEIGHT 17.410 CM FROM BOTTOM INSIDE VESSEL
4 —— 22 HEIGHT 19.380 CM FROM BOTTOM INSIDE VESSEL
TEMPERATURE IN C
60
50
40
30
20
0
2
4
6
8
10
TIME IN MINUTES


WITHOUT EXPLOSAFE: TEST 16
FILL - 76 PERCENT
Q IN - 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 17 HEIGHT 21.465 CM FROM BOTTOM INSIDE VESSEL
2 18 HEIGHT 24.585 CM FROM BOTTOM INSIDE VESSEL
3 —— 21 HEIGHT 25.450 CM FROM BOTTOM INSIDE VESSEL
4 —— 9 HEIGHT 26.590 CM FROM BOTTOM INSIDE VESSEL
TEMPERATURE IN C
60
50
40
30
20
0
2
4
6
8
10
TIME IN MINUTES


WITHOUT EXPLOSAFE: TEST 16
FILL - 76 PERCENT
Q IN - 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 7 HEIGHT 27.510 CM FROM BOTTOM INSIDE VESSEL
2 2 HEIGHT 29.630 CM FROM BOTTOM INSIDE VESSEL
3 —— 4 HEIGHT 30.490 CM FROM BOTTOM INSIDE VESSEL
4 —— 6 HEIGHT 31.550 CM FROM BOTTOM INSIDE VESSEL
TEMPERATURE IN C
70
60
50
40
30
20
0
2
4
6
8
10
TIME IN MINUTES


WITHOUT EXPLOSAFE: TEST 16
FILL = 76 PERCENT
Q IN = 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 6 HEIGHT 31.550 CM FROM BOTTOM INSIDE VESSEL
2 —— 1 HEIGHT 32.460 CM FROM BOTTOM INSIDE VESSEL
3 —— 8 HEIGHT 34.650 CM FROM BOTTOM INSIDE VESSEL
4 5 HEIGHT 35.625 CM FROM BOTTOM INSIDE VESSEL
TEMPERATURE IN C
90
80
70
60
50
40
30
20
0
2
4
6
8
10
TIME IN MINUTES

FOLLOWING ARE HEIGHT VS TEMPERATURE

PLOTS FOR THE

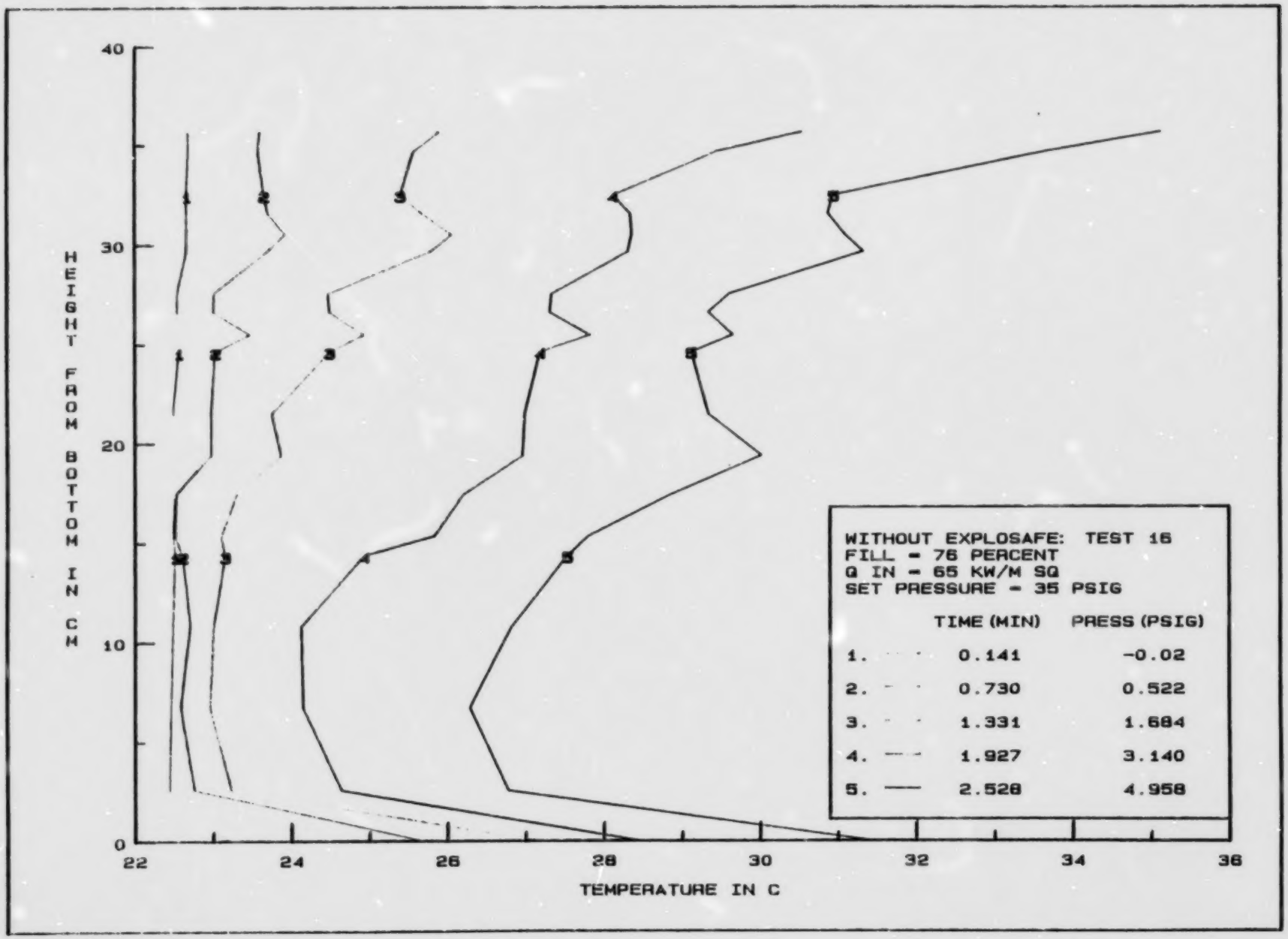
THERMOCOUPLES PLACED AT THE CENTRE

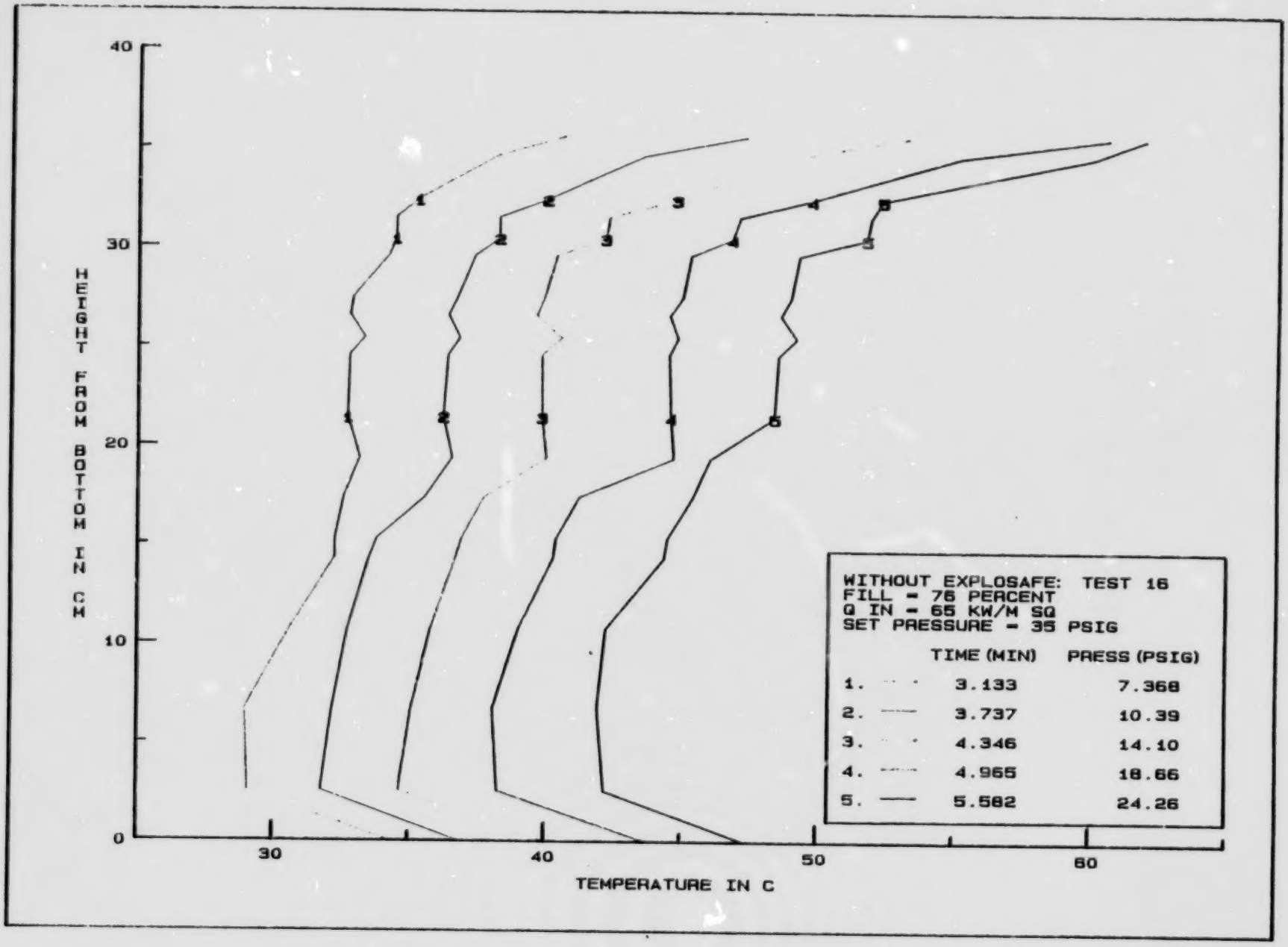
OF THE VESSEL

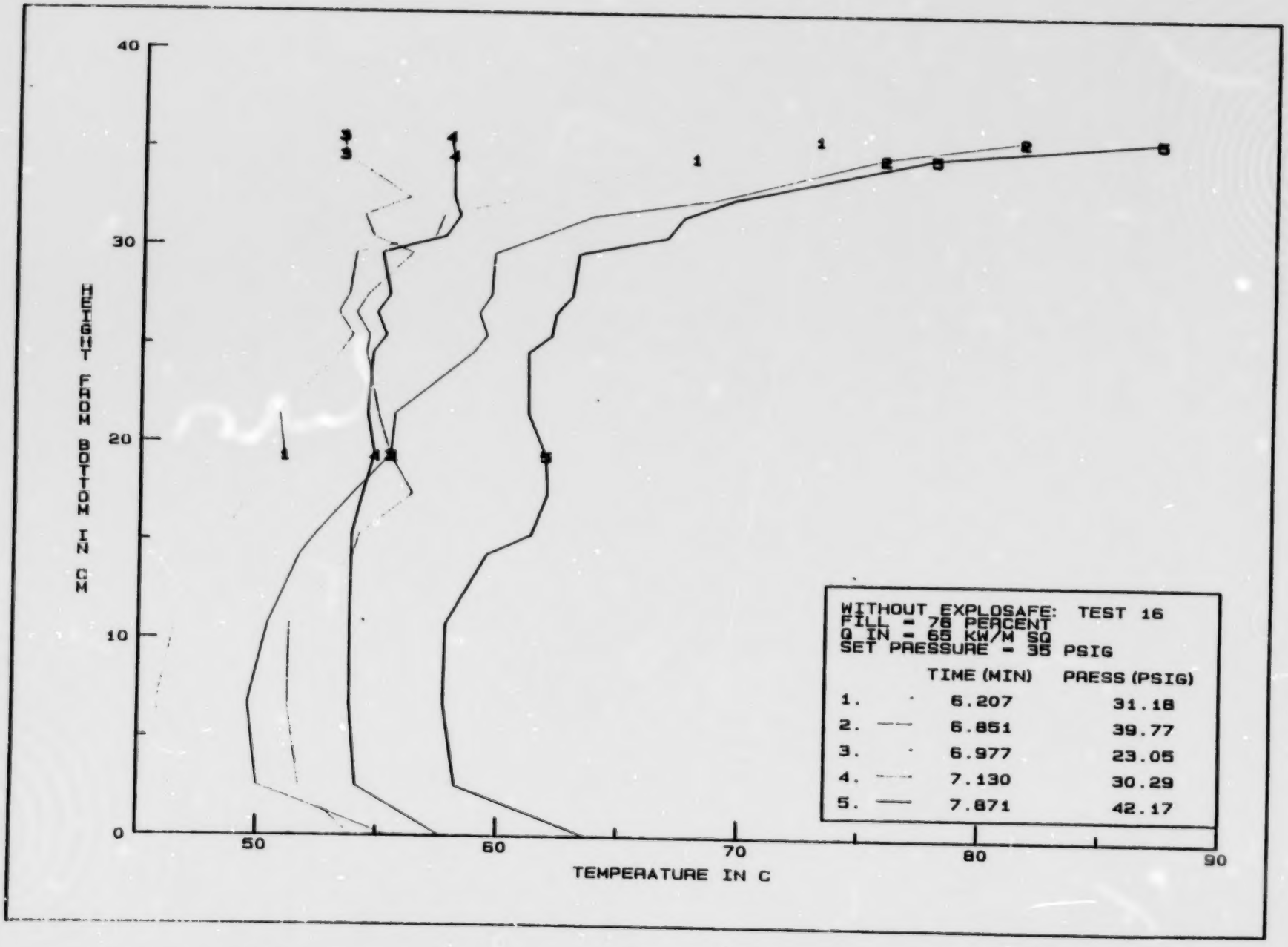
IN A VERTICAL AXIS.

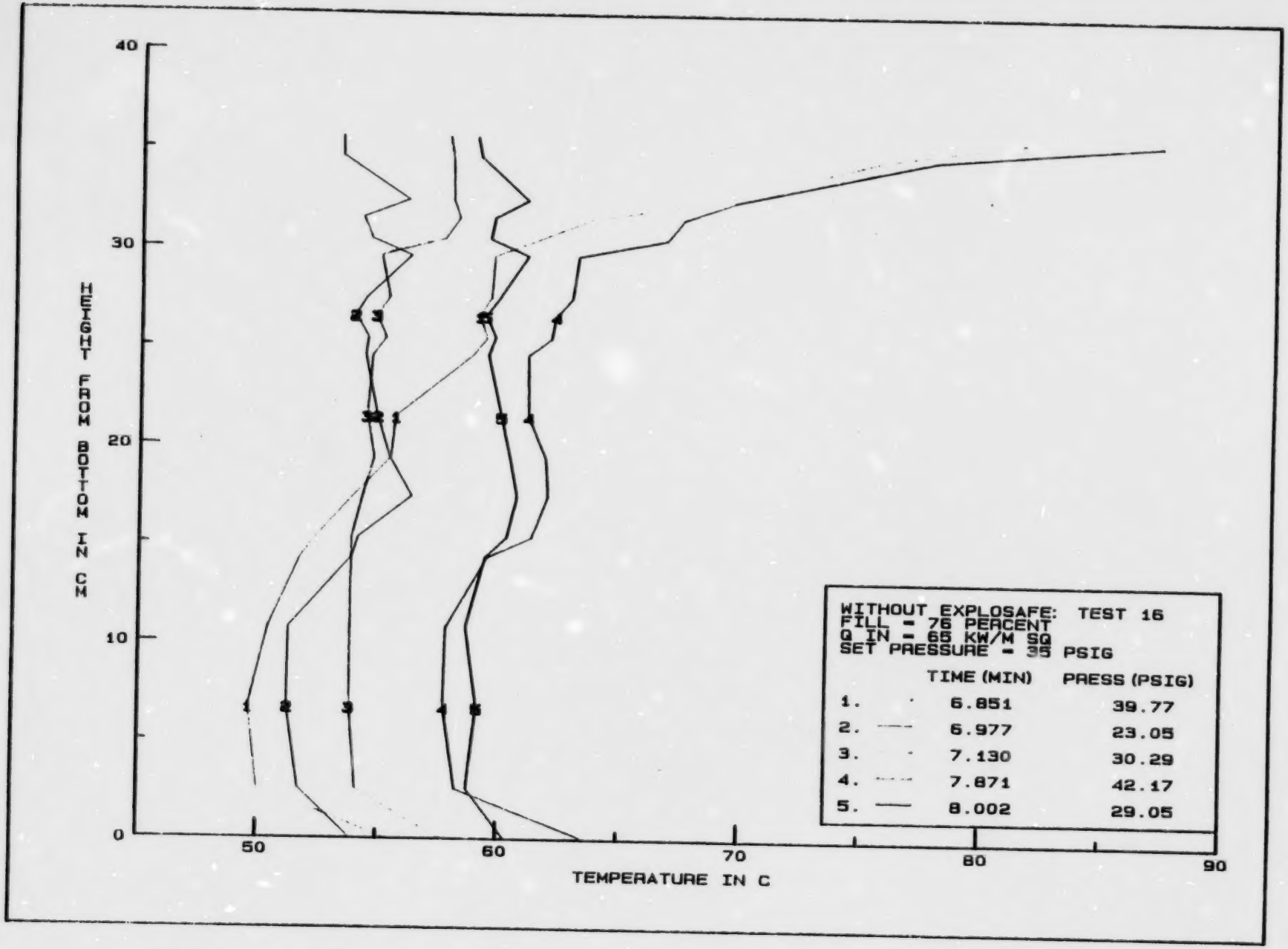
* EACH PLOT REPRESENTS ONE SCAN OF ALL THE THERMOCOUPLES

* PLOTS ARE GIVEN AS FIVE (5) SCANS PER PAGE


HEIGHT FROM BOTTOM IN CM
0
10
20
30
40
22
24
26
28
30
32
34
36
TEMPERATURE IN C
WITHOUT EXPLOSAFE: TEST 16
FILL = 76 PERCENT
Q IN = 65 KW/M SQ
SET PRESSURE = 35 PSIG
TIME (MIN) PRESS (PSIG)
1. 0.141 -0.02
2. 0.730 0.522
3. 1.331 1.684
4. 1.927 3.140
5. 2.528 4.958

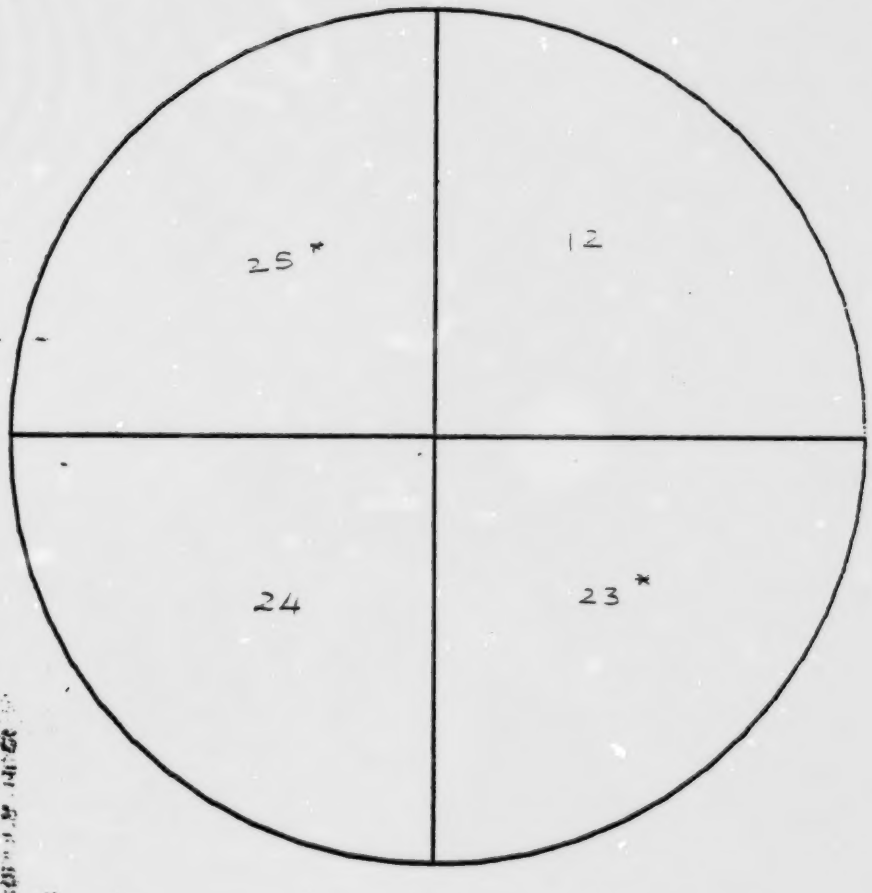

HEIGHT FROM BOTTOM IN CM
40
30
20
10
0
30
40
50
60
TEMPERATURE IN C
WITHOUT EXPLOSAFE: TEST 16
FILL - 76 PERCENT
Q IN - 65 KW/M SQ
SET PRESSURE - 35 PSIG
TIME (MIN) PRESS (PSIG)
1. 3.133 7.368
2. 3.737 10.39
3. 4.346 14.10
4. 4.965 18.66
5. 5.582 24.26


HEIGHT FROM BOTTOM IN CM
0
10
20
30
40
50
60
70
80
90
TEMPERATURE IN C
WITHOUT EXPLOSAFE: TEST 16
FILL = 76 PERCENT
Q IN = 65 KW/M SQ
SET PRESSURE = 35 PSIG
TIME (MIN) PRESS (PSIG)
1. 6.207 31.18
2. 6.851 39.77
3. 6.977 23.05
4. 7.130 30.29
5. 7.871 42.17


HEIGHT FROM BOTTOM IN CM
0
10
20
30
40
50
60
70
80
90
TEMPERATURE IN C
WITHOUT EXPLOSAFE: TEST 16
FILL - 76 PERCENT
Q IN - 65 KW/M SQ
SET PRESSURE - 35 PSIG
TIME (MIN) PRESS (PSIG)
1. 6.851 39.77
2. 6.977 23.05
3. 7.130 30.29
4. 7.871 42.17
5. 8.002 29.05

FOLLOWING FOUR THERMOCOUPLES ARE PLACED

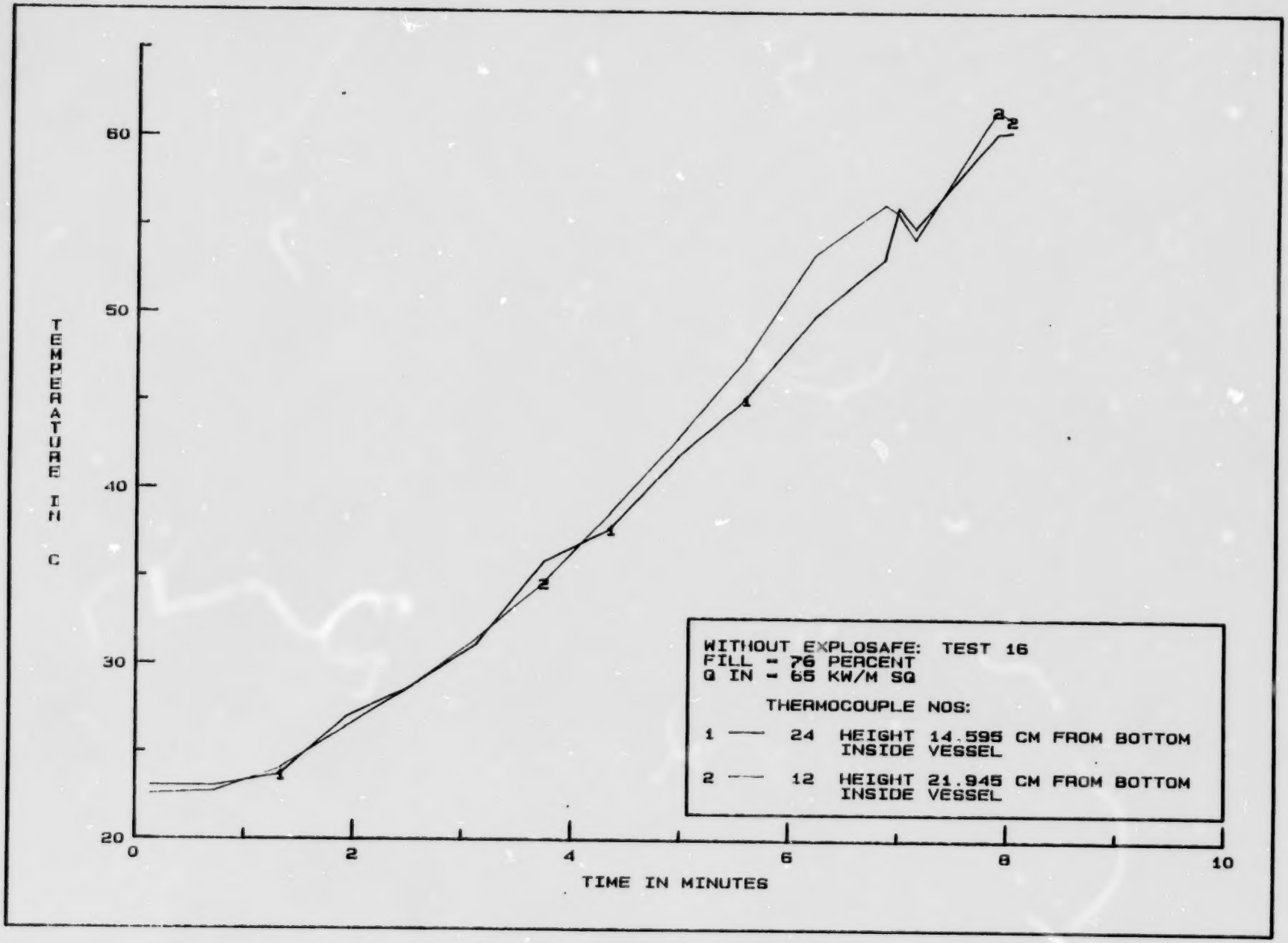
AT THE FOUR QUADRANTS ON A VERTICAL PLANE

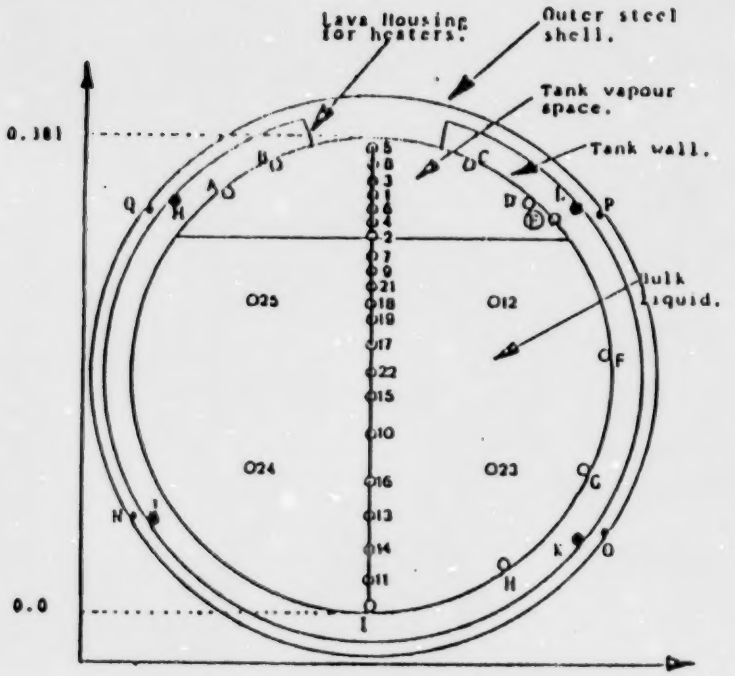


THERMOCOUPLE NUM.	HEIGHT FROM BOTTOM IN cm
24 AND 23	14.595
25 AND 12	21.945

PLOTS ARE GIVEN TWO PER PAGE

*** Thermocouple Nos. 23 and 25 were FAULTY during experiment ***


TEMPERATURE IN C
60
50
40
30
20
0
2
4
6
8
10
TIME IN MINUTES
WITHOUT EXPLOSAFE: TEST 16
FILL - 76 PERCENT
Q IN - 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 24 HEIGHT 14.595 CM FROM BOTTOM INSIDE VESSEL
2 —— 12 HEIGHT 21.945 CM FROM BOTTOM INSIDE VESSEL



SYMBOL	Thermocouple #	Angle(Deg)
A	28	310
B & C	37 & 29	340 & 22
D & E	36 & 34	55 & 56
F & G	27 & 38	92 & 116
H & I	35 & 26	144 & 180
J & K	30 & 31	133 & 220
L & M	32 & 33	50 & 300
N & O	42 & 43	140 & 230
P & Q	39 & 41	60 & 310

○ Circled thermocouple is inserted inside the vapour space wall.

Number 45 represents time in seconds.
Number 44 represents pressure in psig.
Reference upper diameter = 48.37 cms.

Thermocouple numbers.	Height (cm)	Angle with the vertical (Deg.)	Doubtful or faulty Thermocouple.
05	45.88	-	-
08	44.905	-	-
03	43.63	-	YES
01	42.715	-	-
06	41.805	-	-
04	40.745	-	-
02	39.885	-	-
07	37.765	-	-
09	36.845	-	-
21	35.705	-	-
18	34.84	-	-
19	33.86	-	YES
17	31.72	-	-
22	29.635	-	-
15	27.665	-	-
10	25.585	-	-
16	24.585	-	-
13	21.02	-	-
14	16.94	-	-
11	12.81	-	-
26	10.255	180	-
29 & 36	-	22 & 55	-
28 & 37	-	310 & 340	-
27 & 38	-	92 & 116	-
35	-	144	-
30 & 31	-	133 & 220	-
32 & 33	-	50 & 300	-
39 & 41	-	60 & 310	-
42 & 43	-	140 & 230	-
34	-	56	YES
23 & 25	-	-	YES
12	32.20	-	-
24	24.85	-	-
20 & 40	Reference temperature	-	-

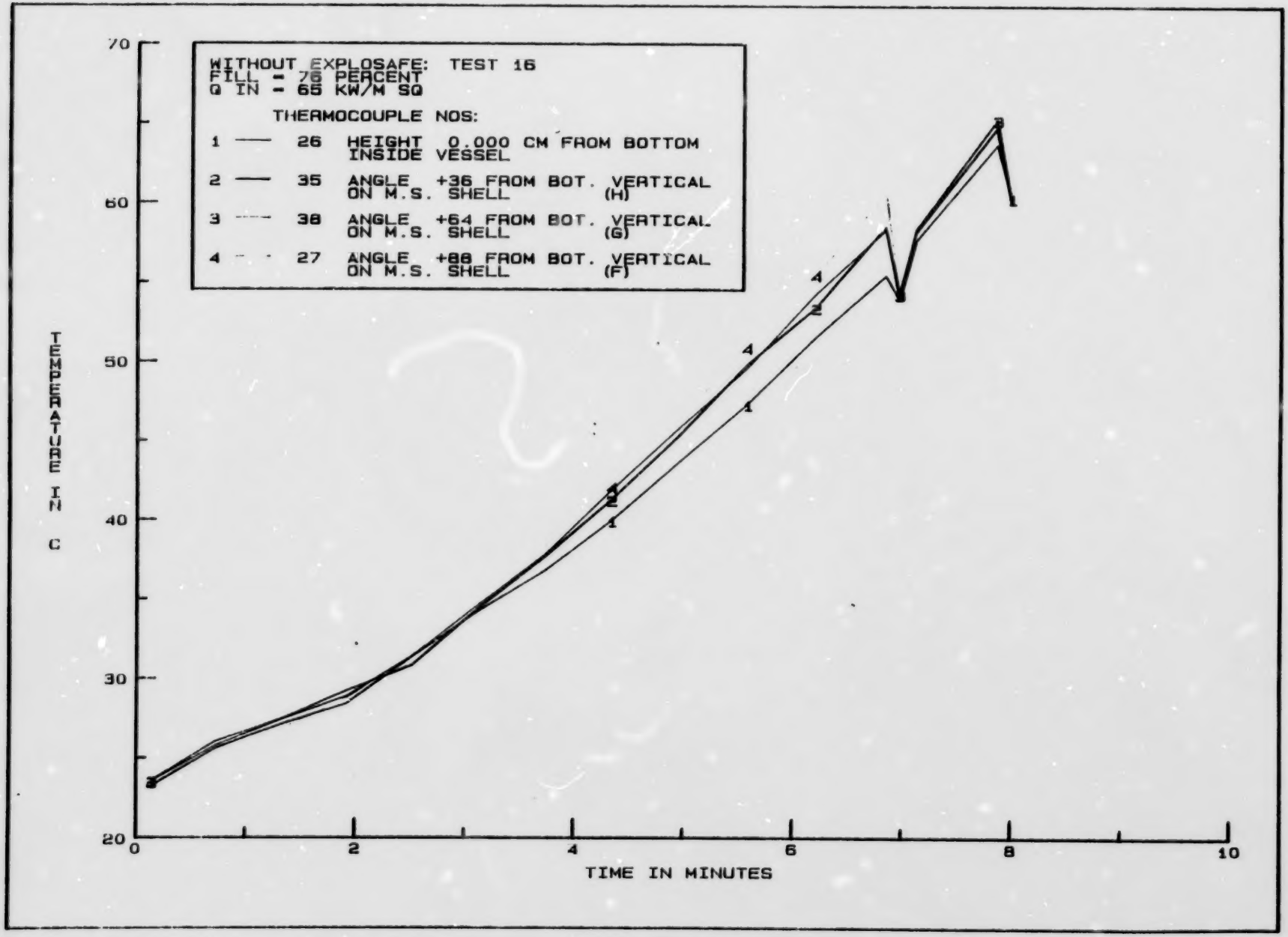
Fig. III.B A grid layout of thermocouples along with their locations for an unprotected vessel(UNB) with the PRV orifice of 3/8 in. (Valid for 76, 58 and 23 percent liquid full cases)

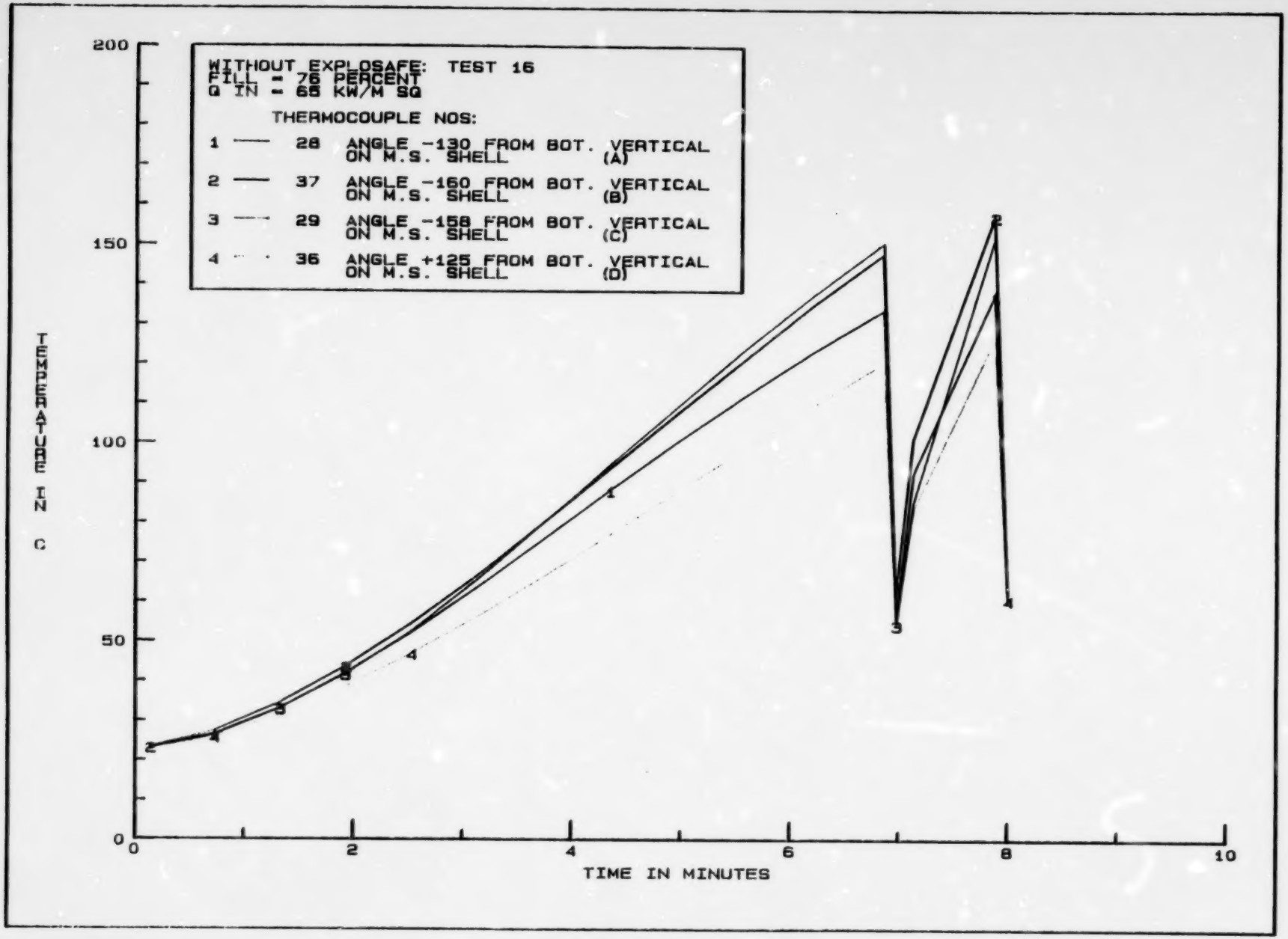
FOLLOWING THERMOCOUPLES ARE PLACED

ON THE MILD STEEL SHELL OR

INSIDE THE MILD STEEL SHELL

THERMOCOUPLE NUM.	ANGLE FROM BOTTOM VERTICAL
ON THE MILD STEEL SHELL:	
26 OR I	00
27 OR F	+88
28 OR A	−130
29 OR C	−158
35 OR H	+36
36 OR D	+125
37 OR B	−160
38 OR G	+64
INSIDE THE MILD STEEL SHELL:	
34 OR E	+124

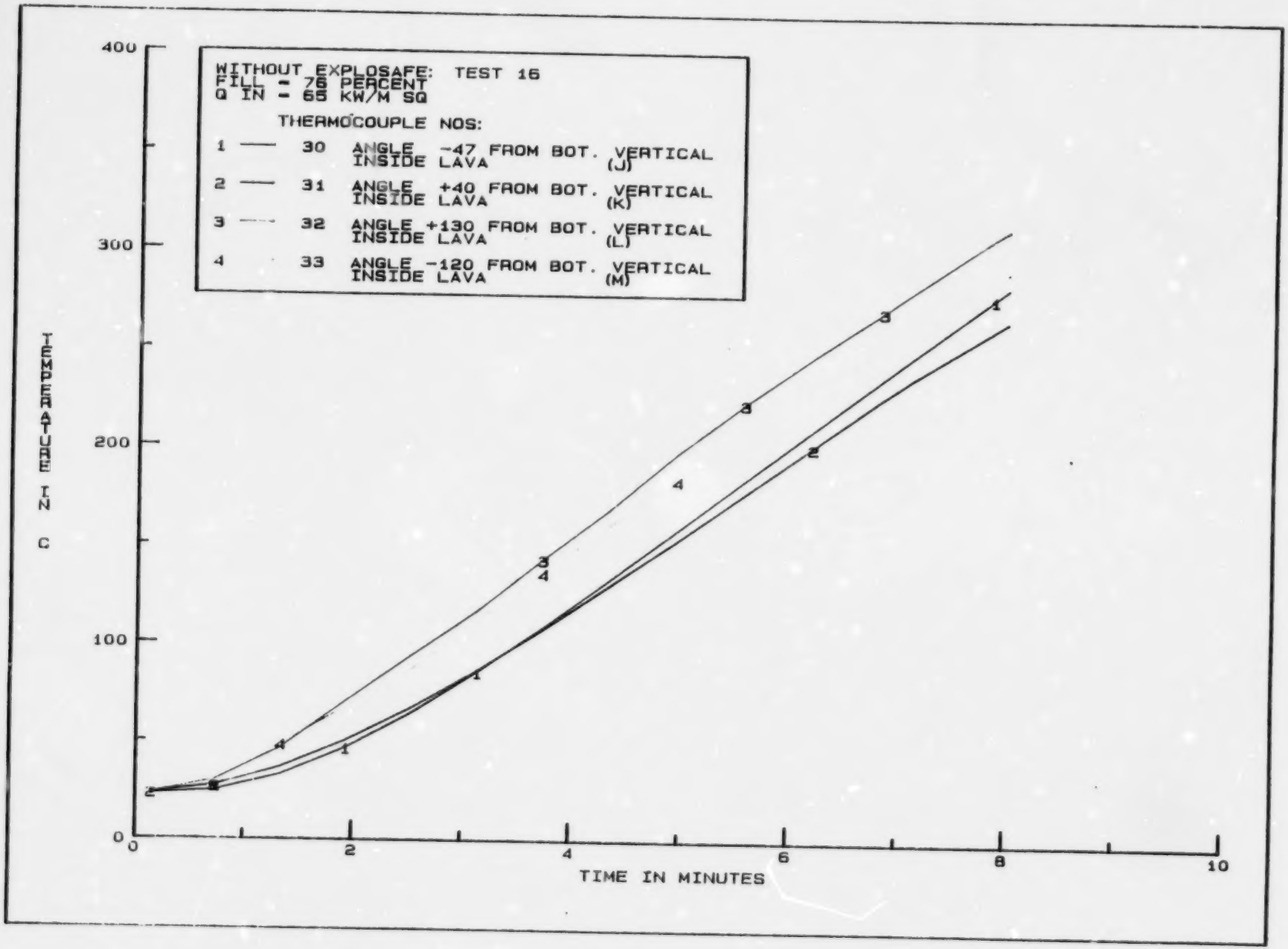

WITHOUT EXPLOSAFE: TEST 16
FILL = 76 PERCENT
Q IN = 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 26 HEIGHT 0.000 CM FROM BOTTOM INSIDE VESSEL
2 —— 35 ANGLE +36 FROM BOT. VERTICAL ON M.S. SHELL (H)
3 —— 38 ANGLE +64 FROM BOT. VERTICAL ON M.S. SHELL (G)
4 — · 27 ANGLE +88 FROM BOT. VERTICAL ON M.S. SHELL (F)
TEMPERATURE IN C
70
60
50
40
30
20
0
2
4
6
8
10
TIME IN MINUTES


WITHOUT EXPLOSAFE: TEST 16
FILL = 76 PERCENT
Q IN = 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 28 ANGLE -130 FROM BOT. VERTICAL ON M.S. SHELL (A)
2 —— 37 ANGLE -160 FROM BOT. VERTICAL ON M.S. SHELL (B)
3 —— 29 ANGLE -158 FROM BOT. VERTICAL ON M.S. SHELL (C)
4 —— 36 ANGLE +125 FROM BOT. VERTICAL ON M.S. SHELL (D)
TEMPERATURE IN C
200
150
100
50
0
0
2
4
6
8
10
TIME IN MINUTES

FOLLOWING THERMOCOUPLES ARE PLACED IN THE LAVA MEDIUM

THERMOCOUPLE NUM.	ANGLE FROM BOTTOM VERTICAL
30 OR J	-47
31 OR K	+40
32 OR L	+130
33 OR M	-120

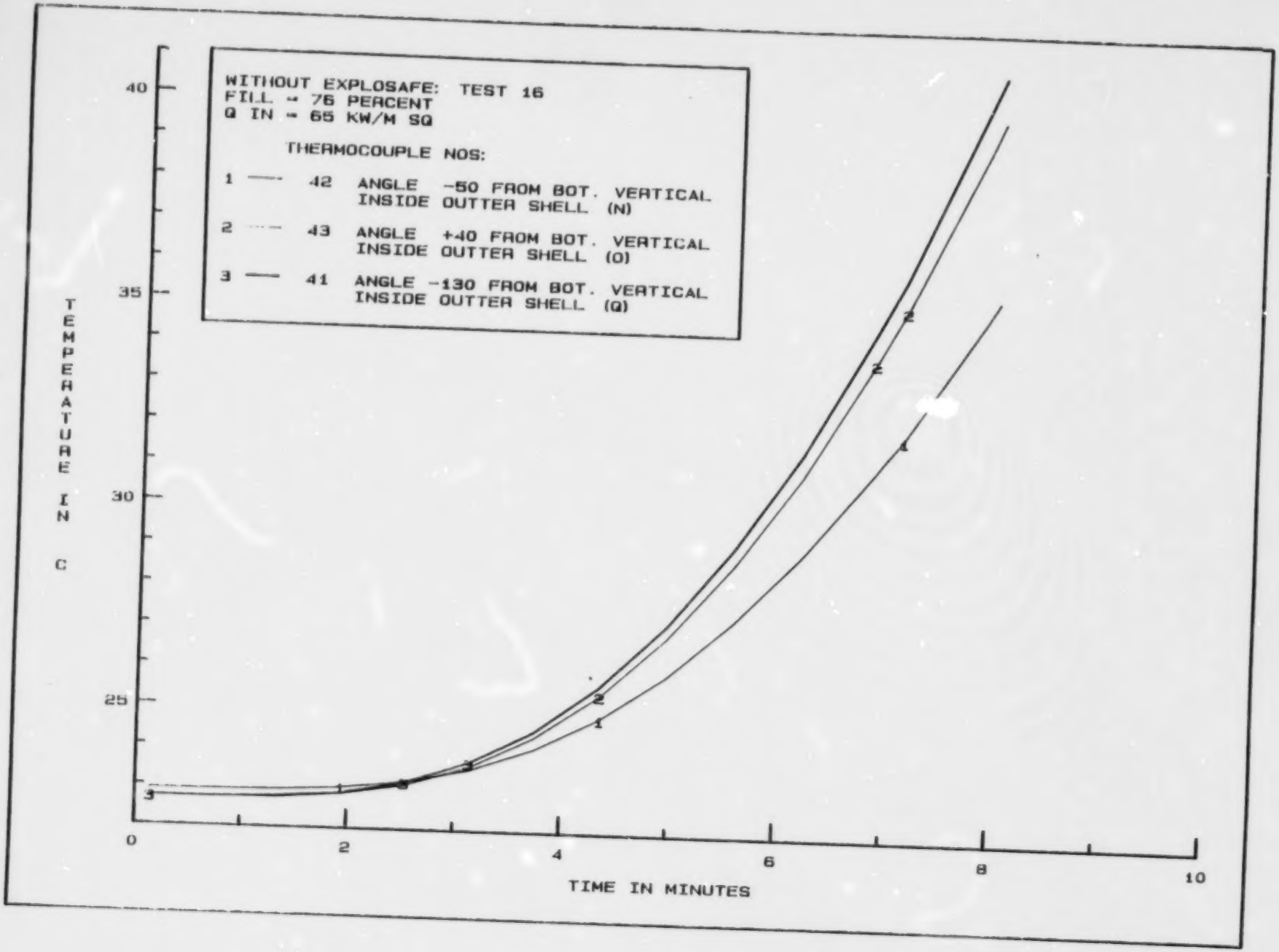
ALL FOUR PLOTS ARE GIVEN ON ONE PAGE


WITHOUT EXPLOSAFE: TEST 16
FILL - 76 PERCENT
Q IN - 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 30 ANGLE -47 FROM BOT. VERTICAL INSIDE LAVA (J)
2 —— 31 ANGLE +40 FROM BOT. VERTICAL INSIDE LAVA (K)
3 —— 32 ANGLE +130 FROM BOT. VERTICAL INSIDE LAVA (L)
4 —— 33 ANGLE -120 FROM BOT. VERTICAL INSIDE LAVA (M)
TEMPERATURE IN C
400
300
200
100
0
0
2
4
6
8
10
TIME IN MINUTES

FOLLOWING THERMOCOUPLES ARE PLACED INSIDE THE OUTTER SHELL

THERMOCOUPLE NUM.	ANGLE FROM BOTTOM VERTICAL
39 OR P	+120
41 OR Q	-130
42 OR N	-50
43 OR O	+40

ALL FOUR PLOTS ARE GIVEN ON ONE PAGE


WITHOUT EXPLOSAFE: TEST 16
FILL = 76 PERCENT
Q IN = 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 42 ANGLE -50 FROM BOT. VERTICAL INSIDE OUTTER SHELL (N)
2 ---- 43 ANGLE +40 FROM BOT. VERTICAL INSIDE OUTTER SHELL (O)
3 —— 41 ANGLE -130 FROM BOT. VERTICAL INSIDE OUTTER SHELL (Q)
TEMPERATURE IN C
40
35
30
25
0
2
4
6
8
10
TIME IN MINUTES

TEST 16

WITHOUT EXPLOSAFE

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITHOUT EXPLOSAFE - FILE NAME : TEST 16

DATE OF TEST = FEB 1, 1984 Q IN = 65 KW/M SQ LIQUID LEVEL = 76 PERCENT

SET PRESSURE = 35 PSIG PRV ORIFICE DIAMETER = 3/8 INCHES

	TIME MINS	PRESSURE PSIG	THRM#1 C	THRM#2 C	THRM#3 C	THRM#4 C	THRM#5 C	THRM#6 C	THRM#7 C	THRM#8 C	THRM#9 C	THRM#10 C	THRM#11 C
1.	0.141	-0.026	22.658	22.658	896.730	22.658	22.683	22.658	22.535	22.683	22.535	22.485	22.436
2.	0.730	0.522	23.646	23.697	935.770	23.918	23.597	23.696	23.005	23.572	23.005	22.511	22.758
3.	1.331	1.684	25.395	25.788	*******	26.058	25.886	25.665	24.460	25.567	24.485	23.105	23.228
4.	1.928	3.141	28.113	28.309	*******	28.357	30.526	28.333	27.331	29.431	27.306	25.836	24.632
5.	2.528	4.958	30.942	31.330	*******	31.087	35.125	30.869	29.604	33.678	29.336	27.798	26.771
6.	3.134	7.369	35.269	34.185	*******	34.426	40.584	34.450	32.856	38.125	32.736	32.227	29.044
7.	3.737	10.394	39.988	37.359	*******	38.245	47.276	38.245	36.712	43.504	36.375	33.799	31.767
8.	4.346	14.106	44.736	40.372	*******	42.132	53.233	42.274	39.896	49.154	39.610	36.906	34.622
9.	4.956	18.665	49.716	45.279	*******	46.786	60.585	47.068	44.973	55.157	44.500	40.373	38.249
10.	5.562	24.263	52.328	49.273	*******	51.747	61.958	51.910	48.969	60.014	48.594	44.478	42.181
11.	6.207	31.181	60.771	53.816	*******	57.098	73.029	57.444	53.538	67.861	53.097	48.549	46.342
12.	6.852	39.779	68.721	59.606	*******	61.460	81.577	63.626	59.491	75.776	58.987	52.310	49.979
13.	6.977	23.052	56.017	56.156	*******	54.491	53.239	54.121	54.329	53.262	53.842	54.097	51.705
14.	7.131	30.292	57.861	54.885	*******	57.538	57.677	58.137	55.255	57.815	54.723	53.796	54.074
15.	7.871	42.176	69.537	63.107	*******	66.739	87.305	67.439	62.856	77.913	62.195	61.282	58.233
16.	8.003	29.059	60.984	61.030	*******	59.427	58.831	59.611	59.863	68.991	59.290	60.275	58.716

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITHOUT EXPLOSAFE - FILE NAME : TEST 16

DATE OF TEST = FEB 1, 1984 Q IN = 65 KW/M SQ LIQUID LEVEL = 76 PERCENT

SET PRESSURE = 35 PSIG PRV ORIFICE DIAMETER = 3/8 INCHES

	TIME MINS	PRESSURE PSIG	THRM#12 C	THRM#13 C	THRM#14 C	THRM#15 C	THRM#16 C	THRM#17 C	THRM#18 C	THRM#19 C	THRM#20 C	THRM#21 C	THRM#22 C
1.	0.141	-0.026	22.559	22.485	22.460	22.510	22.510	22.485	22.559	891.730	2.713	22.930	22.930
2.	0.730	0.522	22.733	22.709	22.585	22.536	22.610	22.980	23.030	912.770	2.714	23.474	22.980
3.	1.331	1.684	24.091	23.006	22.957	23.302	23.154	23.746	24.485	965.810	2.714	24.928	23.869
4.	1.928	3.141	26.425	24.115	24.139	26.204	24.927	26.988	27.184	*******	2.714	27.820	26.964
5.	2.528	4.958	28.727	26.820	26.280	28.848	27.530	29.336	29.117	*******	2.714	29.653	30.018
6.	3.134	7.369	31.500	30.602	28.946	32.542	32.227	32.663	32.736	*******	2.714	33.292	33.122
7.	3.737	10.394	34.667	32.736	32.179	35.558	33.509	36.207	36.375	*******	2.714	36.808	36.544
8.	4.346	14.106	38.684	35.778	35.080	37.721	36.690	39.824	39.800	*******	2.714	40.539	39.991
9.	4.966	18.665	42.939	39.014	38.057	41.230	40.278	44.548	44.477	*******	2.714	44.807	44.666
10.	5.582	24.263	47.469	42.229	41.920	45.398	44.360	48.383	48.524	*******	2.714	49.180	46.034
11.	6.207	31.181	53.399	46.483	45.754	49.579	48.010	50.700	53.236	*******	2.715	53.724	50.933
12.	6.852	39.779	56.294	50.376	49.559	53.842	51.682	55.555	56.757	*******	2.715	59.331	55.393
13.	6.977	23.052	55.763	51.239	51.193	56.294	53.842	54.815	54.283	*******	2.715	54.398	55.347
14.	7.131	30.292	54.306	53.750	53.773	54.236	53.796	54.375	54.584	*******	2.715	55.116	54.699
15.	7.871	42.176	61.647	57.773	57.704	61.944	59.473	61.099	61.053	*******	2.715	62.013	61.830
16.	8.003	29.059	61.122	58.601	59.106	60.687	59.404	59.977	59.404	*******	2.715	59.702	60.367

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITHOUT EXPLOSAFE - FILE NAME : TEST 16

DATE OF TEST = FEB 1, 1984 . Q IN = 65 KW/M SQ LIQUID LEVEL = 76 PERCENT

SET PRESSURE = 35 PSIG PRV ORIFICE DIAMETER = 3/8 INCHES

	TIME MINS	PRESSURE PSIG	THRM#23 C	THRM#24 C	THRM#25 C	THRM#26 C	THRM#27 C	THRM#28 C	THRM#29 C	THRM#30 C	THRM#31 C	THRM#32 C	THRM#33 C
1.	0.141	-0.026	0.000	23.004	0.000	23.220	23.258	23.026	23.142	22.716	23.336	23.026	23.587
2.	0.730	0.522	*******	23.030	*******	25.656	25.559	26.390	26.563	24.690	27.084	29.685	32.319
3.	1.331	1.684	*******	23.721	*******	27.143	26.835	33.126	33.106	32.838	36.440	46.309	48.490
4.	1.928	3.141	*******	26.964	*******	28.453	28.780	42.069	41.726	46.631	50.118	70.210	67.332
5.	2.528	4.958	0.000	28.727	*******	31.437	31.610	52.351	52.540	64.506	66.847	93.614	86.813
6.	3.134	7.369	*******	31.184	*******	34.315	35.005	63.775	65.687	85.703	86.073	116.610	111.630
7.	3.737	10.394	14.891	35.847	0.000	36.843	38.353	75.919	79.898	108.480	107.140	143.070	136.080
8.	4.346	14.106	*******	37.745	0.000	39.994	42.128	88.312	94.555	132.800	129.510	168.510	160.790
9.	4.966	18.665	*******	41.895	0.000	43.710	46.426	100.490	109.210	158.260	152.740	197.330	183.680
10.	5.582	24.263	*******	45.186	226.100	47.339	50.918	112.090	123.750	183.990	176.720	222.850	207.240
11.	6.207	31.181	256.180	49.836	*******	51.581	55.489	123.330	137.570	209.890	201.130	247.020	229.780
12.	6.852	39.779	*******	53.216	0.000	55.453	60.667	133.920	150.860	236.300	226.170	270.320	251.830
13.	6.977	23.052	572.300	56.109	*******	53.907	54.039	56.754	54.548	241.420	230.720	275.220	255.850
14.	7.131	30.292	*******	54.931	0.000	57.676	58.410	92.809	85.468	247.720	236.450	280.920	260.680
15.	7.871	42.176	749.500	60.298	311.500	63.709	65.452	138.010	152.400	277.590	261.110	308.140	285.780
16.	8.003	29.059	557.500	60.413	*******	60.330	60.048	62.246	60.142	282.860	265.670	312.480	290.890

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITHOUT EXPLOSAFE - FILE NAME : TEST 16

DATE OF TEST = FEB 1, 1984 Q IN = 65 KW/M SQ LIQUID LEVEL = 76 PERCENT

SET PRESSURE = 35 PSIG PRV ORIFICE DIAMETER = 3/8 INCHES

	TIME MINS	PRESSURE PSIG	THRM#34 C	THRM#35 C	THRM#36 C	THRM#37 C	THRM#38 C	THRM#39 C	THRM#40 C	THRM#41 C	THRM#42 C	THRM#43 C
1.	0.141	-0.026	23.161	23.587	22.987	23.258	23.510	0.000	2.679	22.697	22.890	22.716
2.	0.730	0.522	26.834	26.062	25.849	27.412	25.772	49.682	2.679	22.697	22.910	22.716
3.	1.331	1.684	32.684	27.490	31.225	34.525	27.413	12.927	2.680	22.756	22.930	22.736
4.	1.928	3.141	39.305	29.262	38.484	43.687	28.877	0.000	2.679	22.852	23.007	22.852
5.	2.528	4.958	45.817	30.880	47.050	54.466	31.437	43.784	2.680	23.163	23.183	23.105
6.	3.134	7.369	52.918	34.469	56.332	66.660	34.679	32.417	2.680	23.686	23.512	23.589
7.	3.737	10.394	59.853	37.704	66.399	79.935	37.818	0.000	2.680	24.480	24.055	24.345
8.	4.346	14.106	66.492	41.290	77.053	93.559	41.881	56.163	2.680	25.639	24.846	25.426
9.	4.966	18.665	72.957	45.344	87.963	107.470	45.819	27.705	2.680	27.185	25.930	26.895
10.	5.582	24.263	78.805	49.821	98.778	121.120	49.594	5.823	2.680	29.152	27.322	28.748
11.	6.207	31.181	82.723	53.414	109.710	135.030	54.263	10.935	2.680	31.538	28.999	31.000
12.	6.852	39.779	85.543	58.523	120.560	148.050	58.316	0.000	2.680	34.495	31.021	33.786
13.	6.977	23.052	54.454	54.152	56.094	62.112	54.265	175.020	2.680	35.106	31.444	34.380
14.	7.131	30.292	59.896	58.166	83.652	101.320	58.316	0.000	2.680	35.855	31.924	35.089
15.	7.871	42.176	85.304	64.740	126.820	157.740	65.246	0.000	2.681	40.117	34.823	39.029
16.	8.003	29.059	59.804	60.105	60.988	62.752	59.936	38.561	2.681	40.899	35.378	39.793

PLOTS OF A TEST

CARRIED OUT ON THE UNB TANK 2

WITHOUT EXPLOSAFE

TEST NUMBER 17

Q in = 65 kW/m sq

LIQUID LEVEL = 58 %

SET PRESSURE = 35 psig

PRV ORIFICE DIAMETER = 3/8 in.

Date of Test FEB 16, 1984

TABLE OF CONTENTS

Thermocouple Grid Layout - - - - - - - - - - - - -

1. For the Thermocouples Placed in a Vertical Line:
   (a) Plots of Temperature Vs Time - - - - - - - -
   (b) Plots of Height Vs. Temperature - - - - - - -

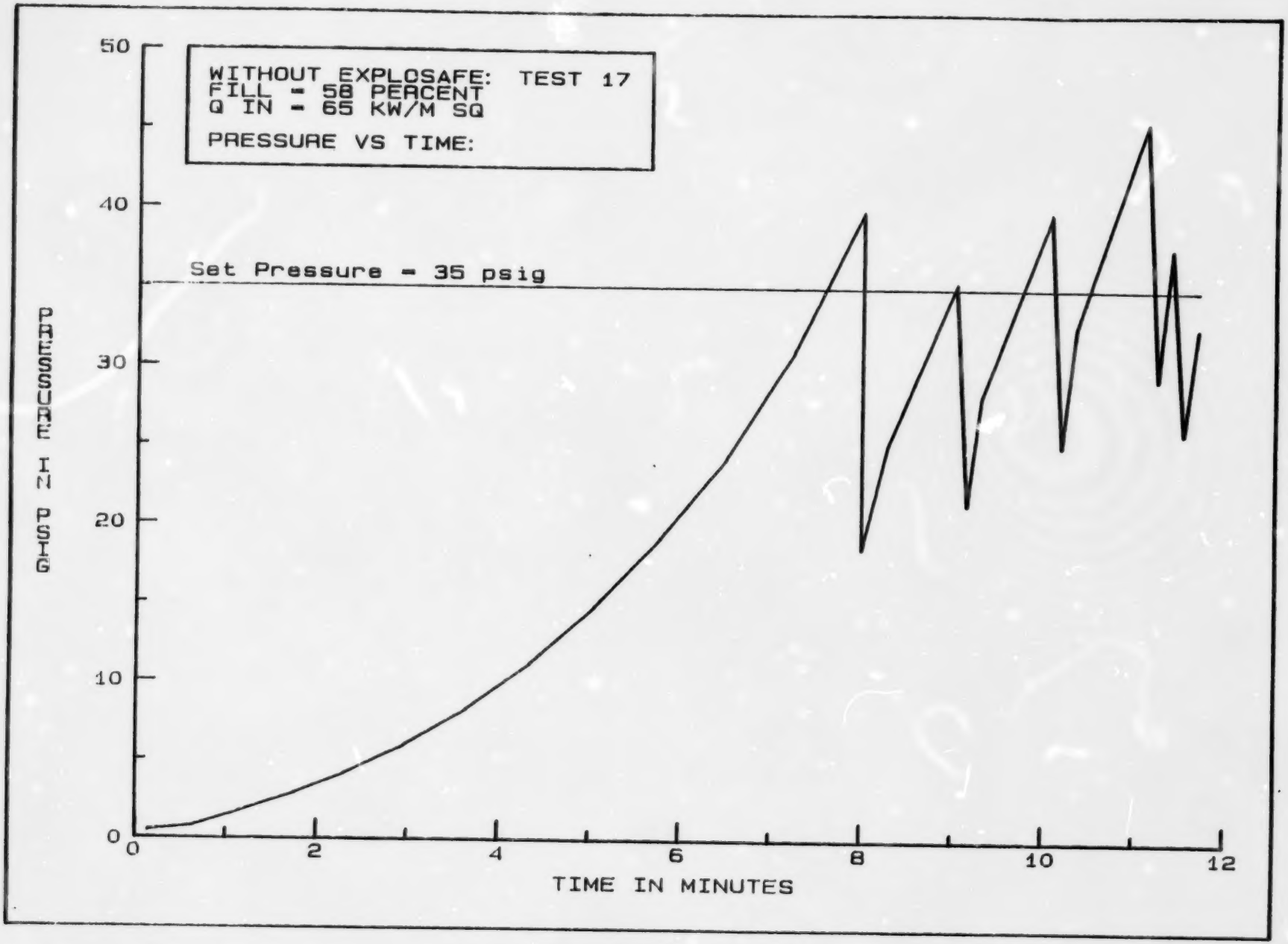
2. Thermocouples Placed in the Four Quadrants
   in a Vertical Plane: Temp. Vs. Time - - - - - -

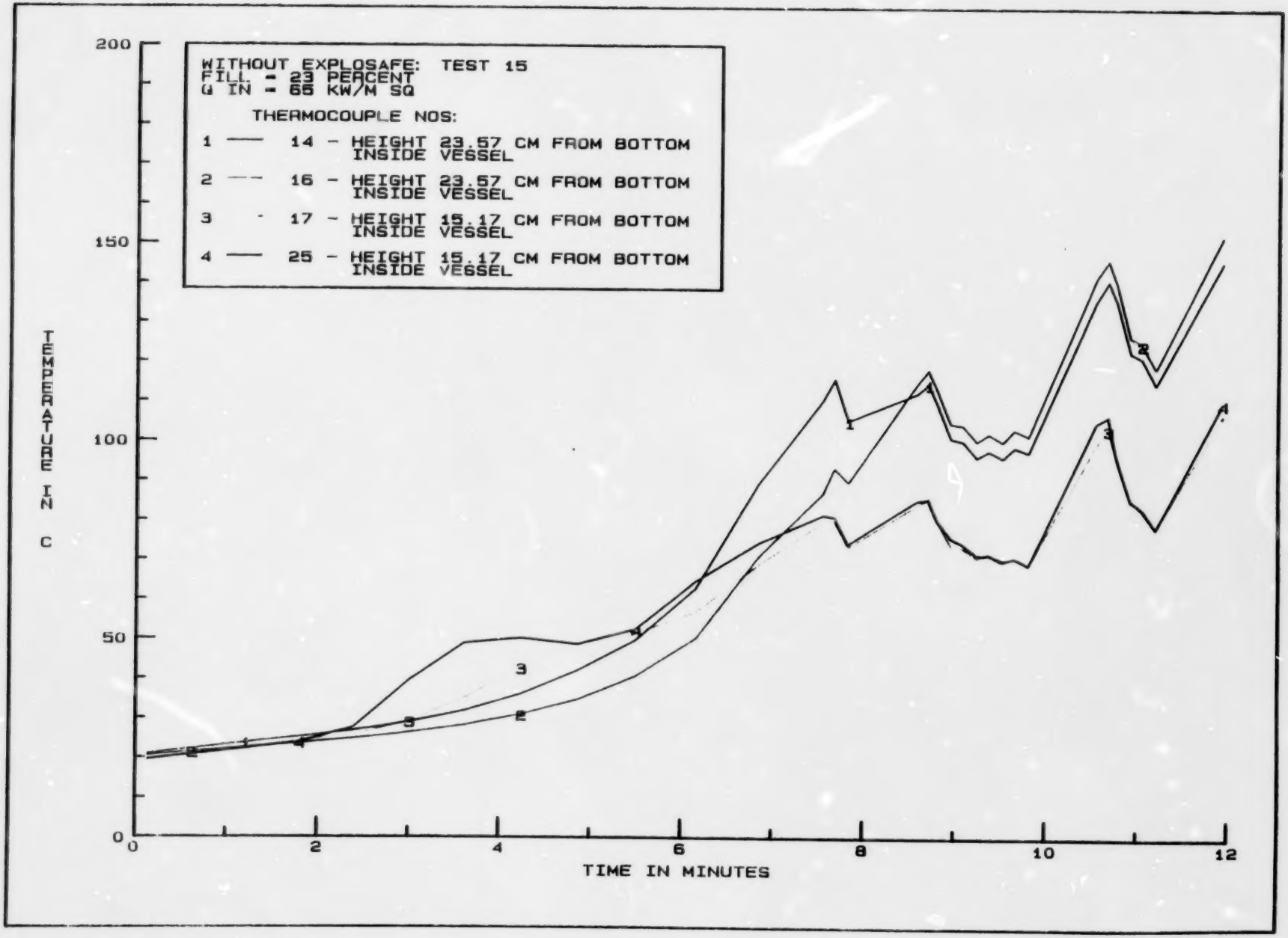
Thermocouple Grid Layout - - - - - - - - - - - -

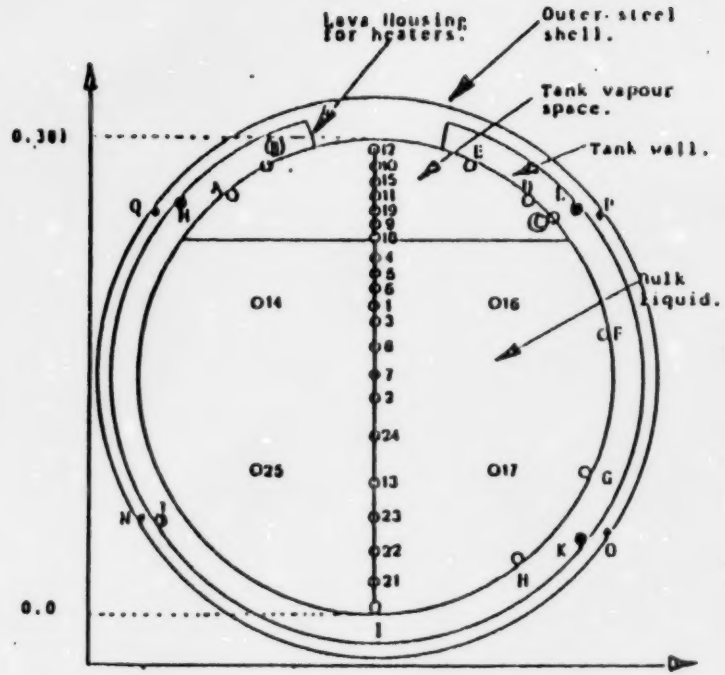
3. Thermocouples Placed On and Inside the
   Mild Steel Shell: Temp. Vs. Time - - - - - - -

4. Thermocouples Placed in the Lava Medium
   Temp. Vs. Time - - - - - - - - - - - - - - - -

6. Print out of Data - - - - - - - - - - - - - -


WITHOUT EXPLOSAFE: TEST 17
FILL = 58 PERCENT
Q IN = 65 KW/M SQ
PRESSURE VS TIME:
Set Pressure = 35 psig
PRESSURE IN PSIG
TIME IN MINUTES
0
10
20
30
40
50
0
2
4
6
8
10
12


WITHOUT EXPLOSAFE: TEST 15
FILL = 23 PERCENT
Q IN = 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 14 - HEIGHT 23.57 CM FROM BOTTOM INSIDE VESSEL
2 —— 16 - HEIGHT 23.57 CM FROM BOTTOM INSIDE VESSEL
3 · 17 - HEIGHT 15.17 CM FROM BOTTOM INSIDE VESSEL
4 —— 25 - HEIGHT 15.17 CM FROM BOTTOM INSIDE VESSEL
TEMPERATURE IN C
200
150
100
50
0
0
2
4
6
8
10
12
TIME IN MINUTES



SYMBOL	Thermocouple #.	Angle (Deg)
A	26	310
B	34	20
C	27	56
D & E	28 & 29	48 & 35
F & G	38 & 35	78 & 110
H & I	37 & 36	142 & 180
J & K	30 & 31	133 & 220
L & M	32 & 33	50 & 300
N & O	42 & 43	140 & 230
P & Q	39 & 41	60 & 310

○ Circled thermocouples are inserted inside the vapour space wall.

Number 44 represents pressure(vessel) in psig.
Number 45 represents time in seconds.
Reference upper diameter = 45.47 cms.

Thermocouple numbers.	Height (cm)	Angle with the vertical (Deg.)	Doubtful or faulty Thermocouple.
12	42.57	-	-
10	41.545	-	-
15	40.495	-	-
11	39.475	-	-
19	38.55	-	YES.
09	37.575	-	-
18	36.595	-	-
04	34.62	-	-
05	33.59	-	-
06	32.60	-	-
01	31.16	-	-
03	30.63	-	YES.
08	29.61	-	-
07	27.635	-	-
02	24.72	-	-
24	22.87	-	-
13	21.83	-	-
23	17.82	-	-
22	14.38	-	-
21	10.31	-	-
36	07.63	180	-
26	-	310	-
27 & 28	-	56 & 48	-
29 & 38	-	25 & 78	-
35 & 37	-	110 & 142	-
30 & 31	-	133 & 220	-
33 & 34	-	300 & 20	YES.
32 & 39	-	50 & 60	-
41 & 42	-	310 & 140	-
43	-	230	-
14	31.2	-	-
16	31.2	-	-
25	22.8	-	-
17	22.8	-	-
20 & 40	Reference Temperature	-	-

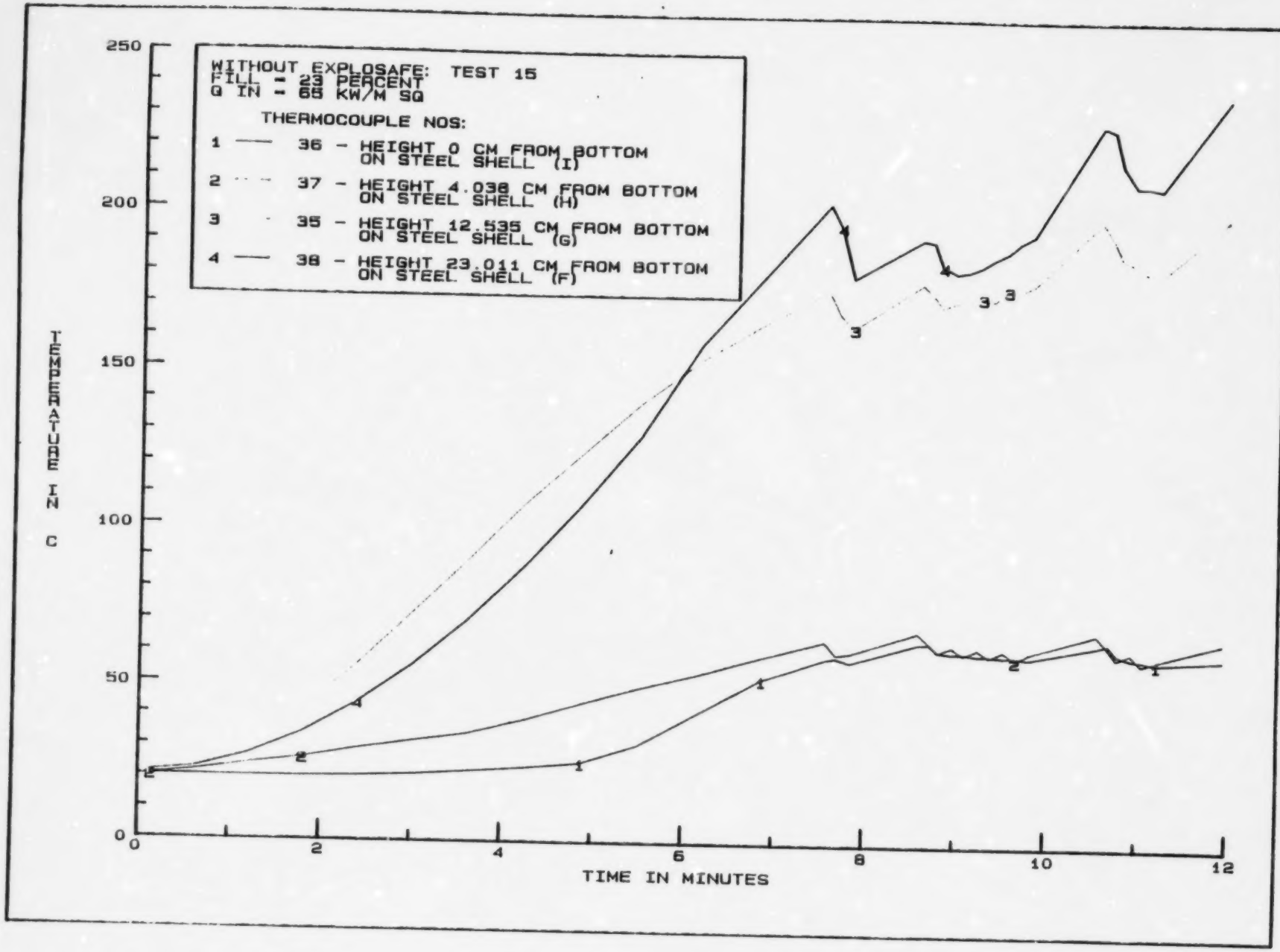
Fig. III.A A grid layout of thermocouples along with their locations for an unprotected vessel(UNB) with the PRV orifice of 1/4 in. (Valid for 76, 58 and 23 percent liquid full cases)

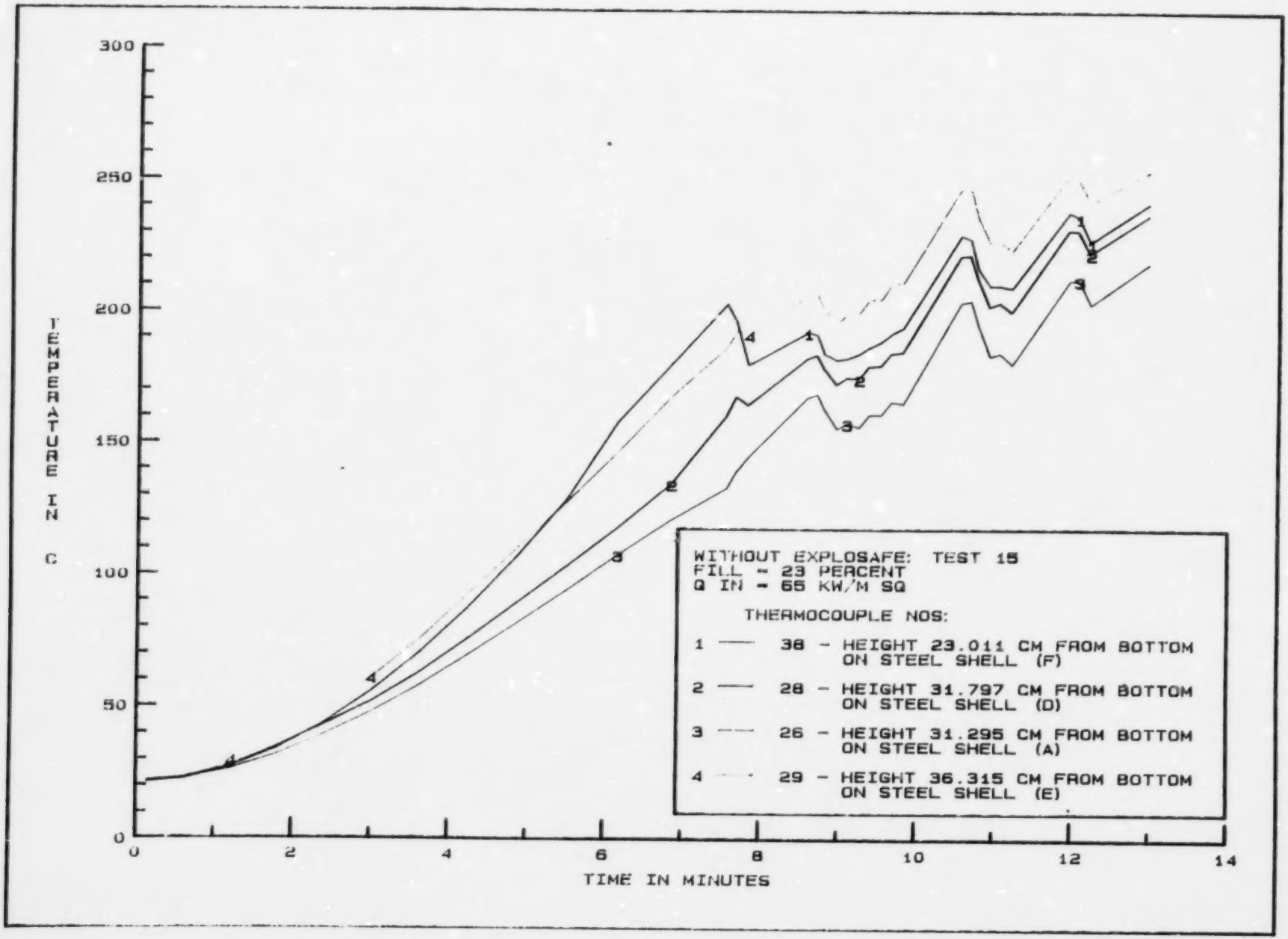
FOLLOWING THERMOCOUPLES ARE PLACED

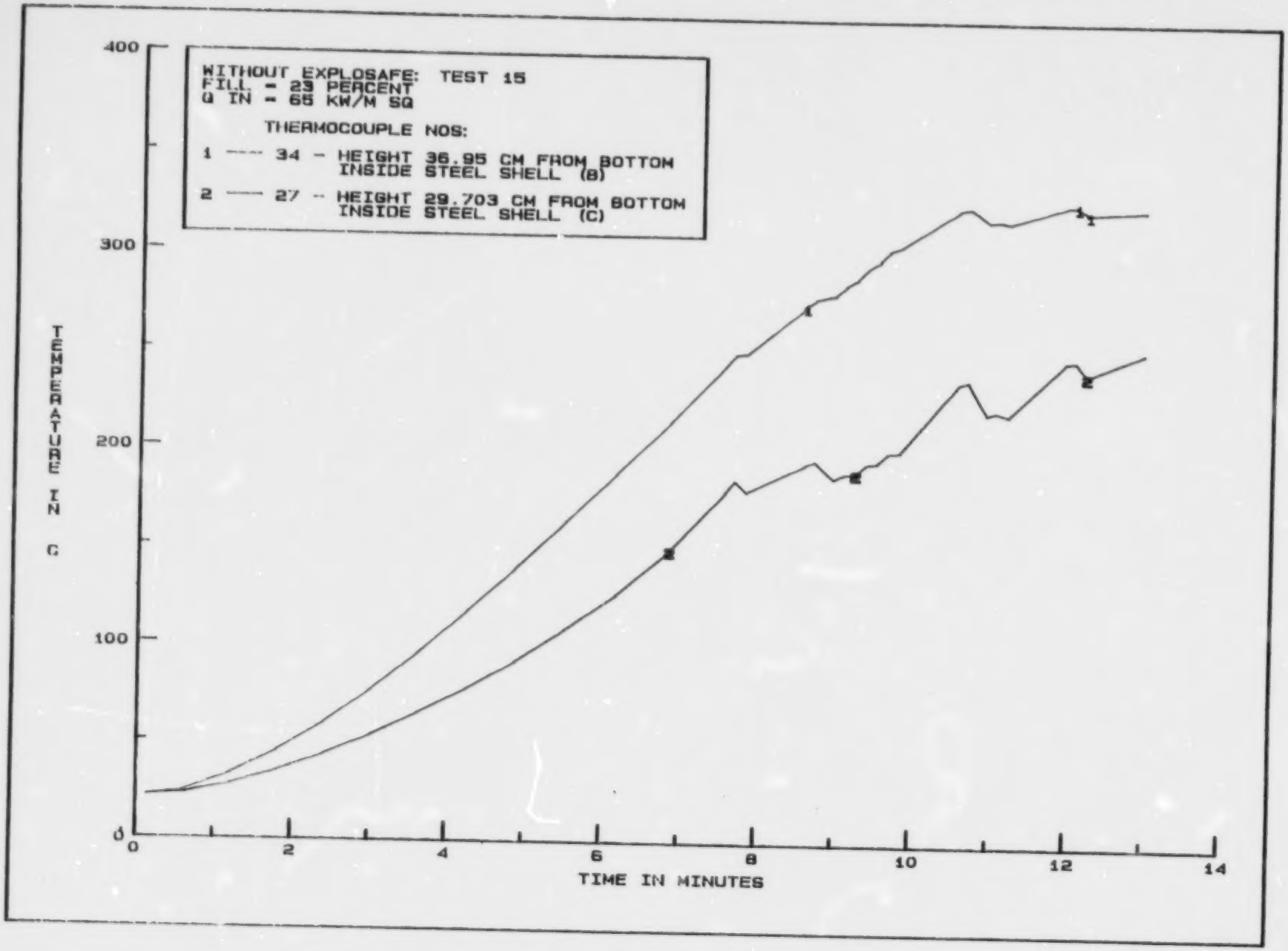
ON THE MILD STEEL SHELL OR

INSIDE THE MILD STEEL SHELL

THERMOCOUPLE NUM.	HEIGHT FROM BOTTOM IN CM
ON THE MILD STEEL SHELL:	
36 OR I	0
37 OR H	4.038
38 OR G	12.535
35 OR F	23.011
29 OR D	31.797
28 OR A	31.295
39 OR E	36.315
INSIDE THE MILD STEEL SHELL:	
34 OR B	36.95
27 OR C	29.703


WITHOUT EXPLOSAFE: TEST 15
FILL = 23 PERCENT
Q IN = 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 36 - HEIGHT 0 CM FROM BOTTOM ON STEEL SHELL (I)
2 - - - 37 - HEIGHT 4.038 CM FROM BOTTOM ON STEEL SHELL (H)
3 · · 35 - HEIGHT 12.535 CM FROM BOTTOM ON STEEL SHELL (G)
4 —— 38 - HEIGHT 23.011 CM FROM BOTTOM ON STEEL SHELL (F)
TEMPERATURE IN C
250
200
150
100
50
0
0
2
4
6
8
10
12
TIME IN MINUTES


300
250
200
150
100
50
0
TEMPERATURE IN C
0
2
4
6
8
10
12
14
TIME IN MINUTES
WITHOUT EXPLOSAFE: TEST 15
FILL - 23 PERCENT
Q IN - 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 38 - HEIGHT 23.011 CM FROM BOTTOM ON STEEL SHELL (F)
2 —— 28 - HEIGHT 31.797 CM FROM BOTTOM ON STEEL SHELL (D)
3 —— 26 - HEIGHT 31.295 CM FROM BOTTOM ON STEEL SHELL (A)
4 —— 29 - HEIGHT 36.315 CM FROM BOTTOM ON STEEL SHELL (E)

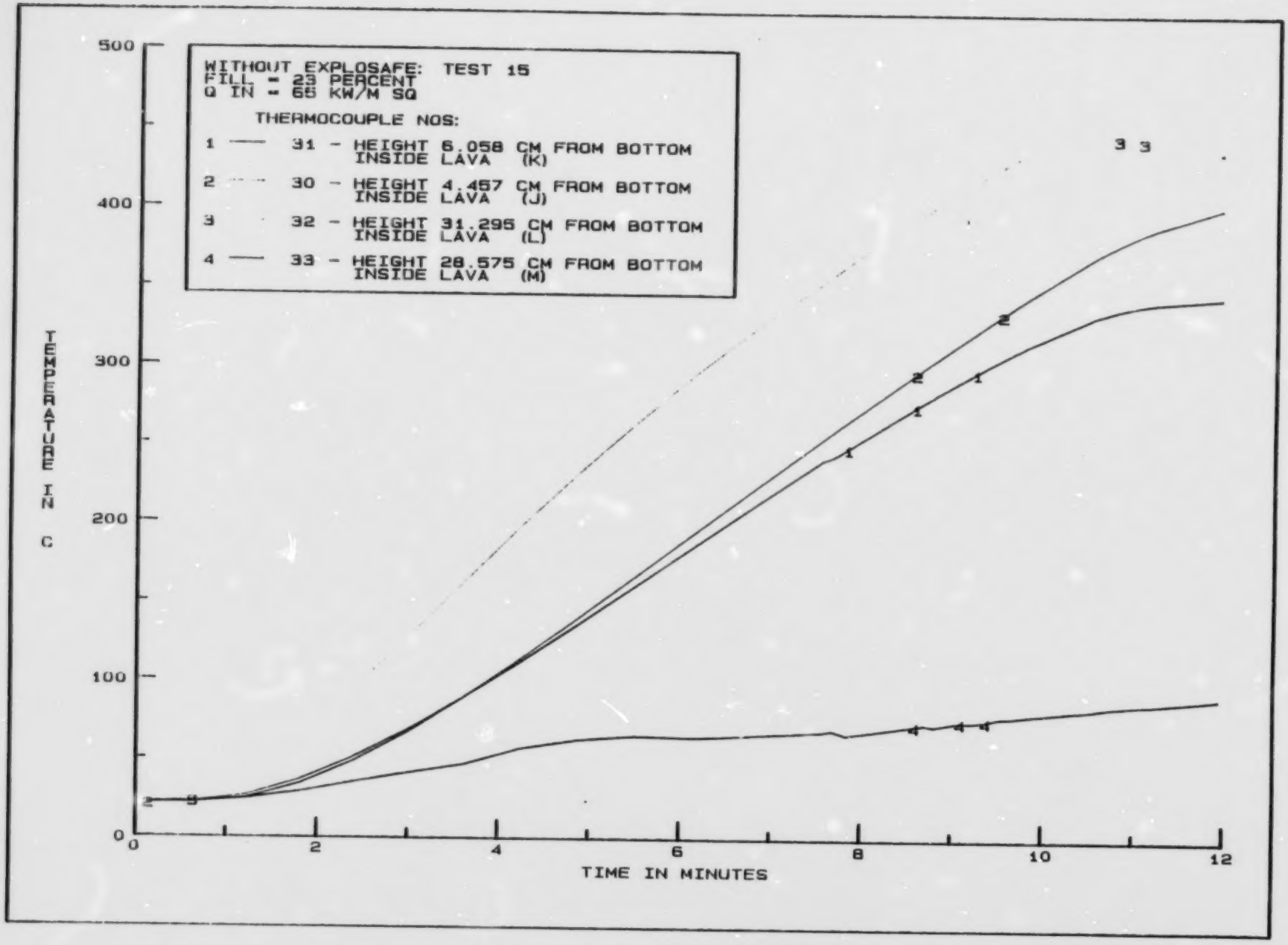

WITHOUT EXPLOSAFE: TEST 15
FILL = 23 PERCENT
Q IN = 65 KW/M SQ
THERMOCOUPLE NOS:
1 ---- 34 - HEIGHT 36.95 CM FROM BOTTOM INSIDE STEEL SHELL (B)
2 ---- 27 - HEIGHT 29.703 CM FROM BOTTOM INSIDE STEEL SHELL (C)
400
300
200
100
0
TEMPERATURE IN C
0
2
4
6
8
10
12
14
TIME IN MINUTES

FOLLOWING THERMOCOUPLES ARE PLACED

IN THE LAVA MEDIUM

THERMOCOUPLE NUM.	HEIGHT FROM BOTTOM IN CM
31 OR K	6.058
30 OR J	4.457
32 OR L	31.295
33 OR M	28.575

ALL FOUR PLOTS ARE GIVEN IN ONE PAGE

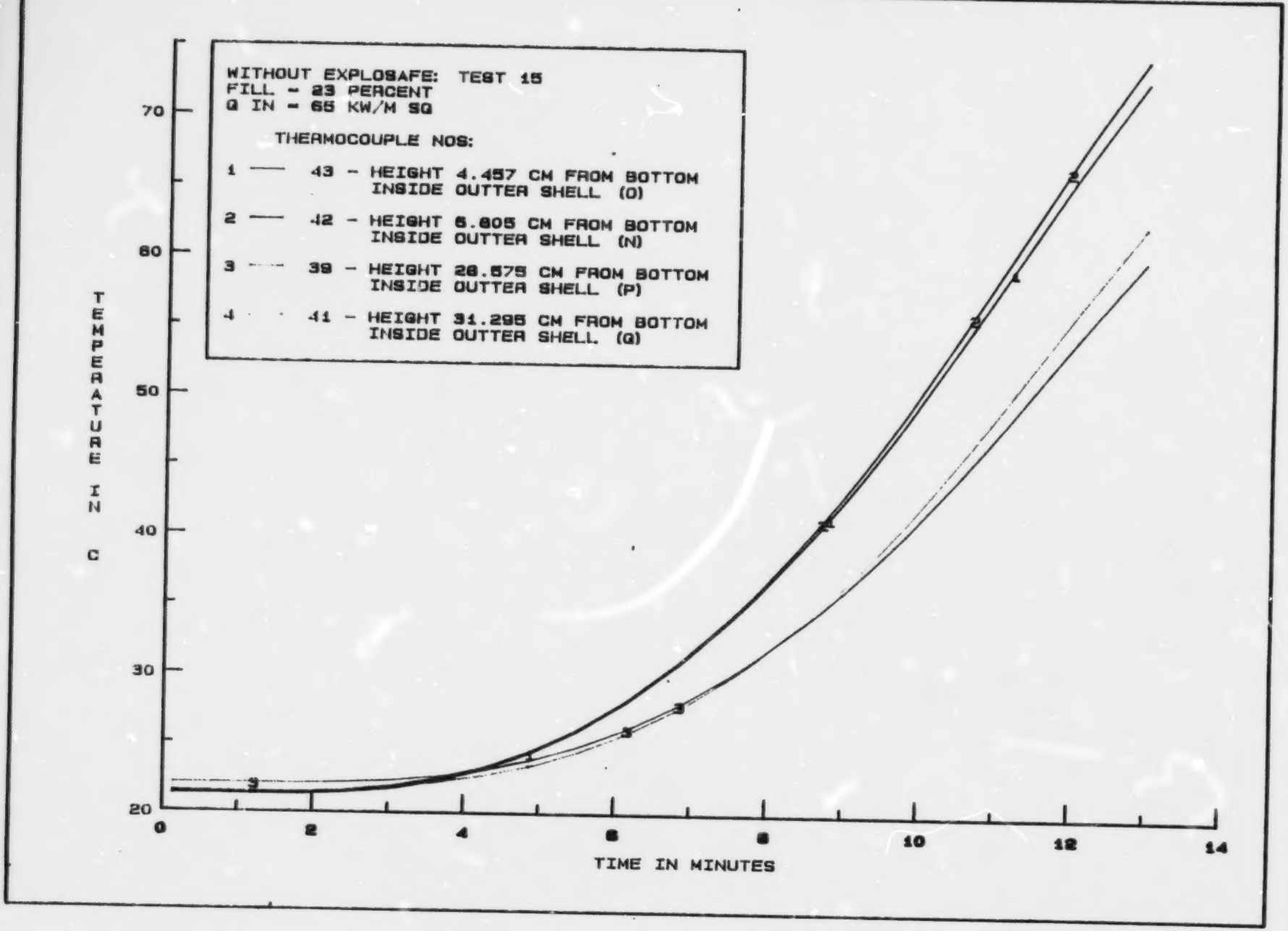

WITHOUT EXPLOSAFE: TEST 15
FILL = 23 PERCENT
Q IN = 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 31 - HEIGHT 6.058 CM FROM BOTTOM INSIDE LAVA (K)
2 - - - 30 - HEIGHT 4.457 CM FROM BOTTOM INSIDE LAVA (J)
3 32 - HEIGHT 31.295 CM FROM BOTTOM INSIDE LAVA (L)
4 —— 33 - HEIGHT 28.575 CM FROM BOTTOM INSIDE LAVA (M)
TEMPERATURE IN C
500
400
300
200
100
0
0
2
4
6
8
10
12
TIME IN MINUTES

FOLLOWING THERMOCOUPLES ARE PLACED

INSIDE THE OUTER SHELL

THERMOCOUPLE NUM.	HEIGHT FROM BOTTOM IN CM
42 OR N	6.805
43 OR O	4.457
41 OR Q	31.295
39 OR P	28.575

ALL FOUR PLOTS ARE GIVEN IN ONE PAGE


WITHOUT EXPLOSAFE: TEST 15
FILL - 23 PERCENT
Q IN - 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 43 - HEIGHT 4.457 CM FROM BOTTOM INSIDE OUTTER SHELL (O)
2 —— 42 - HEIGHT 6.805 CM FROM BOTTOM INSIDE OUTTER SHELL (N)
3 —— 39 - HEIGHT 28.575 CM FROM BOTTOM INSIDE OUTTER SHELL (P)
4 —— 41 - HEIGHT 31.295 CM FROM BOTTOM INSIDE OUTTER SHELL (Q)
TEMPERATURE IN C
70
60
50
40
30
20
0
2
4
6
8
10
12
14
TIME IN MINUTES

TEST 15

WITHOUT EXPLOSAFE

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITHOUT EXPLOSAFE - FILE NAME : TEST 15

DATE OF TEST : JAN 18, 1984 Q IN = 65 KW/M SQ LIQUID LEVEL = 23 PERCENT

SET PRESSURE = 35 PSIG PRV ORIFICE DIAMETER = 1/4 INCHES

	TIME MINS	PRESSURE PSIG	THRM#1 C	THRM#2 C	THRM#3 C	THRM#4 C	THRM#5 C	THRM#6 C	THRM#7 C	THRM#8 C	THRM#9 C	THRM#10 C	THRM#11 C
1.	0.139	3.386	20.894	20.943	*******	21.191	21.216	21.042	21.117	21.117	21.340	21.934	21.488
2.	0.630	4.490	21.608	21.682	*******	21.781	21.830	21.657	21.830	21.880	21.806	22.449	22.177
3.	1.213	5.655	22.209	22.308	*******	22.258	22.332	22.184	22.382	22.555	22.060	22.728	22.209
4.	1.804	6.836	22.782	22.880	*******	22.732	22.806	22.683	22.930	23.177	22.559	24.335	22.954
5.	2.403	8.082	23.422	23.570	*******	23.274	23.397	23.298	23.594	23.866	23.126	27.377	25.710
6.	3.012	9.577	24.400	24.744	*******	24.178	24.351	24.203	24.646	24.916	24.449	30.345	28.054
7.	3.618	11.425	25.788	27.650	*******	25.420	25.666	25.469	26.230	26.451	27.259	36.998	31.887
8.	4.244	13.754	27.832	45.449	*******	27.147	27.612	27.391	29.637	28.881	31.047	43.796	36.528
9.	4.868	16.877	30.857	46.724	*******	29.690	30.347	30.103	38.831	33.111	35.282	50.565	41.809
10.	5.504	20.594	36.244	49.047	*******	33.473	34.584	34.632	53.891	45.382	38.544	57.127	47.335
11.	6.164	25.295	46.487	48.483	*******	38.758	40.904	41.878	58.413	50.587	41.855	66.327	53.333
12.	6.850	31.138	53.562	63.237	*******	52.541	57.836	53.585	59.673	57.790	47.612	78.195	59.260
13.	7.557	38.245	73.537	75.589	*******	68.329	66.725	69.050	82.867	80.951	65.026	83.526	63.958
14.	7.683	30.004	81.182	76.600	*******	71.734	70.005	77.444	84.721	85.444	68.497	87.039	68.857
15.	7.835	38.132	78.232	68.509	*******	72.777	70.737	75.389	74.319	78.875	72.531	94.968	78.454
16.	8.587	43.036	96.789	84.834	*******	104.650	101.480	99.854	92.736	97.240	91.328	107.530	105.410
17.	8.713	35.564	100.400	86.332	*******	107.660	104.760	102.660	95.981	100.360	102.040	119.650	113.090
18.	8.808	32.053	98.028	82.369	*******	104.390	101.450	99.056	91.127	96.267	100.850	111.610	109.090
19.	8.964	36.930	87.942	73.243	*******	93.778	90.465	88.683	79.512	85.780	93.821	105.780	101.760
20.	9.092	31.044	88.452	73.207	*******	95.382	91.819	89.453	79.875	85.702	98.326	114.940	107.730
21.	9.248	36.024	85.886	69.336	*******	92.110	88.745	86.651	76.850	82.706	97.112	112.310	106.640
22.	9.376	30.214	88.884	71.816	*******	96.606	93.070	90.015	79.827	85.480	102.230	120.660	112.930
23.	9.531	35.345	87.588	69.176	*******	94.571	90.981	88.503	78.068	84.000	99.896	114.840	109.740
24.	9.660	29.338	91.422	72.574	*******	99.390	95.849	93.283	81.567	87.247	105.990	125.680	118.380
25.	9.815	34.335	90.022	69.623	*******	97.493	93.704	91.281	79.813	85.662	103.650	120.110	113.730
26.	10.560	43.384	132.620	106.030	*******	140.110	135.630	133.560	118.450	126.950	147.170	172.190	160.840
27.	10.688	34.249	136.490	110.090	*******	143.740	139.670	137.160	121.980	130.970	150.230	170.410	161.160
28.	10.784	29.974	130.850	103.530	*******	137.570	133.160	130.610	114.500	124.470	142.000	150.310	148.600
29.	10.936	35.173	112.640	86.407	*******	120.610	115.410	112.980	95.861	106.620	125.470	133.130	132.800
30.	11.061	27.593	110.880	85.713	*******	119.930	114.620	111.790	96.018	105.160	125.900	141.300	135.920
31.	11.214	32.367	105.150	79.786	*******	113.600	108.740	106.290	91.363	99.546	120.080	134.470	130.120
32.	11.949	39.942	141.570	113.240	*******	149.710	145.670	143.160	126.510	135.560	158.280	181.060	167.350
33.	12.075	30.240	144.740	116.990	*******	153.300	148.520	145.580	129.780	138.870	160.640	180.280	168.880
34.	12.227	34.799	134.310	105.070	*******	142.970	137.950	135.010	117.660	128.200	148.730	161.880	155.830
35.	12.966	41.957	149.480	121.350	*******	159.160	154.370	151.350	134.430	144.050	166.360	190.420	179.610

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITHOUT EXPLOSAFE - FILE NAME : TEST 15

DATE OF TEST : JAN 18, 1984 Q IN = 65 KW/M SQ LIQUID LEVEL = 23 PERCENT

SET PRESSURE = 35 PSIG PRV ORIFICE DIAMETER = 1/4 INCHES

	TIME MINS	PRESSURE PSIG	THRM#12 C	THRM#13 C	THRM#14 C	THRM#15 C	THRM#16 C	THRM#17 C	THRM#18 C	THRM#19 C	THRM#20 C	THRM#21 C	THRM#22 C
1.	0.139	3.386	22.330	20.795	20.819	21.687	20.323	20.894	21.117	832.440	2.322	18.258	18.383
2.	0.630	4.490	22.844	21.286	22.325	22.300	21.434	22.053	21.608	850.250	2.331	18.403	18.528
3.	1.213	5.655	23.049	21.788	23.863	22.357	22.530	23.197	21.862	861.550	2.342	18.884	19.580
4.	1.804	6.836	24.729	22.287	25.294	23.769	23.621	24.335	22.287	880.720	2.352	19.734	21.322
5.	2.403	8.082	28.306	22.953	26.912	26.691	24.826	25.759	22.829	942.660	2.362	21.469	23.619
6.	3.012	9.577	31.972	24.252	29.055	29.396	26.341	29.250	23.735	*******	2.371	23.907	27.174
7.	3.618	11.425	38.315	27.357	31.984	35.629	29.286	35.172	25.248	*******	2.380	27.870	31.292
8.	4.244	13.754	46.532	32.089	36.288	41.021	31.072	42.825	27.758	*******	2.388	34.604	36.744
9.	4.868	16.877	53.914	36.220	42.284	46.559	34.849	44.438	31.367	*******	2.396	40.453	41.286
10.	5.504	20.594	61.028	41.856	49.912	52.475	40.787	51.614	33.908	*******	2.403	45.476	45.995
11.	6.164	25.295	71.061	50.330	63.126	59.423	50.400	57.079	38.758	*******	2.410	50.540	51.333
12.	6.850	31.138	82.236	62.553	89.585	69.598	71.013	69.057	46.955	*******	2.417	56.223	56.869
13.	7.557	38.245	89.165	71.231	110.700	73.112	87.095	79.759	62.979	*******	2.424	61.953	62.888
14.	7.683	30.004	93.791	71.263	115.800	78.973	93.273	80.123	67.684	*******	2.425	61.164	61.255
15.	7.835	33.132	103.590	64.095	105.250	86.222	89.666	73.359	63.867	*******	2.427	59.001	59.689
16.	8.587	43.036	120.860	73.573	112.200	107.610	114.610	84.001	92.130	*******	2.433	65.470	66.399
17.	8.713	35.564	128.310	76.813	114.600	117.000	118.150	85.654	97.550	*******	2.434	65.163	65.571
18.	8.808	32.053	113.900	70.610	109.680	109.270	113.330	80.120	95.966	*******	2.435	62.166	62.486
19.	8.964	36.930	109.370	66.563	100.710	105.390	104.320	73.645	90.509	*******	2.436	61.264	62.192
20.	9.092	31.044	118.880	66.730	100.020	111.760	104.020	73.162	94.951	*******	2.437	61.456	61.685
21.	9.248	36.024	114.780	64.973	95.995	110.800	99.941	70.460	92.954	*******	2.438	60.254	61.375
22.	9.376	30.214	124.940	66.138	97.786	117.320	101.980	71.592	98.537	*******	2.439	60.790	60.927
23.	9.531	35.345	117.450	64.448	95.777	113.730	99.789	69.288	96.659	*******	2.440	59.679	60.801
24.	9.660	29.338	129.010	66.407	98.619	123.000	103.040	71.095	101.800	*******	2.441	60.283	60.329
25.	9.815	34.335	123.460	64.899	97.257	118.760	101.260	69.060	100.210	*******	2.442	58.873	60.042
26.	10.560	43.384	176.450	94.657	135.920	168.490	141.660	99.490	142.850	*******	2.448	66.127	67.303
27.	10.688	34.249	173.530	97.396	140.660	166.390	145.990	103.250	145.170	*******	2.448	65.250	65.182
28.	10.784	29.974	147.720	86.944	135.320	149.190	139.860	95.960	135.890	*******	2.449	61.844	61.475
29.	10.936	35.173	132.270	76.689	122.430	134.720	126.330	84.897	120.980	*******	2.450	59.149	61.096
30.	11.061	27.593	142.590	76.095	120.950	139.200	124.710	83.521	121.380	*******	2.451	59.537	59.339
31.	11.214	32.367	135.670	71.213	114.480	134.040	118.400	78.525	116.130	*******	2.452	57.488	59.923
32.	11.949	39.942	185.740	101.420	145.450	176.320	151.860	106.650	153.970	*******	2.456	63.935	66.295
33.	12.075	30.240	183.160	103.920	148.280	175.130	155.010	109.930	155.480	*******	2.457	62.965	62.053
34.	12.227	34.799	161.680	88.723	140.680	160.780	146.290	98.185	144.100	*******	2.458	59.658	62.083
35.	12.966	41.957	193.130	108.810	155.780	187.270	161.740	115.240	162.600	*******	2.462	65.194	72.540

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITHOUT EXPLOSAFE - FILE NAME : TEST 16

DATE OF TEST : JAN 18, 1984 Q IN = 65 KW/M SQ LIQUID LEVEL = 23 PERCENT

SET PRESSURE = 35 PSIG PRV ORIFICE DIAMETER = 1/4 INCHES

	TIME MINS	PRESSURE PSIG	THRM023 C	THRM024 C	THRM025 C	THRM026 C	THRM027 C	THRM028 C	THRM029 C	THRM030 C	THRM031 C	THRM032 C	THRM033 C
1.	0.139	3.386	19.254	19.155	19.404	21.828	21.440	21.595	22.022	21.421	21.266	21.343	21.905
2.	0.630	4.490	19.996	19.946	20.864	22.768	22.923	23.001	23.775	21.547	22.129	23.059	22.362
3.	1.213	5.655	20.748	20.698	22.407	26.259	27.706	27.629	29.767	24.559	26.549	37.973	24.578
4.	1.804	6.836	21.570	21.421	23.966	31.723	34.716	34.677	38.083	33.757	36.611	63.904	29.088
5.	2.403	8.082	22.656	22.310	27.744	39.333	43.277	42.877	48.252	48.498	51.280	94.340	35.376
6.	3.012	9.577	25.113	24.744	39.665	47.941	53.277	51.765	61.035	67.483	69.241	128.030	41.423
7.	3.618	11.425	29.287	30.357	49.033	57.852	64.800	62.494	75.465	89.286	89.564	162.380	48.874
8.	4.244	13.754	35.374	37.200	60.422	69.549	77.285	75.498	92.737	113.930	112.150	198.060	57.151
9.	4.868	16.877	41.548	41.239	48.789	81.537	91.165	89.095	110.220	139.680	135.850	231.500	62.712
10.	5.504	20.594	47.006	41.167	52.731	94.191	107.780	103.080	127.930	166.690	160.740	263.680	65.504
11.	6.164	25.295	52.427	47.521	64.922	107.730	125.830	117.890	146.920	194.840	186.660	295.630	64.209
12.	6.850	31.138	58.273	59.788	74.526	121.190	148.790	134.620	168.170	224.090	213.470	325.840	66.586
13.	7.557	38.245	67.290	70.377	81.569	133.350	178.590	160.590	186.960	253.820	240.650	353.650	68.661
14.	7.683	30.004	66.848	69.510	80.895	139.730	184.850	167.920	193.000	259.070	243.160	359.020	69.746
15.	7.835	33.132	64.117	64.299	74.207	145.200	178.990	164.570	191.340	265.360	248.440	365.580	66.585
16.	8.587	43.036	67.327	78.534	85.184	167.680	193.380	182.380	206.790	296.140	275.110	394.800	72.975
17.	8.713	35.564	64.936	79.385	85.544	168.910	195.450	183.810	207.430	301.230	279.420	399.260	73.740
18.	8.808	32.053	61.915	72.516	80.231	162.710	191.670	178.370	200.910	305.080	282.700	402.960	72.471
19.	8.964	36.930	68.340	68.663	75.585	155.620	186.440	172.430	196.210	311.300	287.900	408.260	74.336
20.	9.092	31.044	61.090	68.378	74.101	157.860	189.000	175.160	199.540	316.410	292.110	412.710	75.526
21.	9.248	36.024	62.699	66.808	71.336	156.210	189.380	174.760	198.990	322.560	297.020	418.420	75.117
22.	9.376	30.214	62.731	67.825	71.547	161.170	193.960	179.390	205.130	327.610	301.180	422.970	76.180
23.	9.531	35.345	62.970	66.444	70.031	161.190	194.980	179.670	205.200	333.690	305.930	428.010	78.170
24.	9.660	29.338	63.456	68.057	70.623	166.020	199.850	184.350	211.040	338.670	309.810	432.390	78.524
25.	9.815	34.336	63.376	67.051	68.722	166.280	200.410	184.890	211.580	344.630	314.500	437.560	79.471
26.	10.560	43.384	81.251	100.730	104.820	203.710	235.240	221.380	247.380	371.330	333.210	446.740	83.614
27.	10.688	34.249	80.971	102.250	106.600	204.480	237.060	221.700	246.390	375.290	335.400	446.610	84.652
28.	10.784	29.874	74.900	90.970	95.766	195.040	230.180	212.680	235.950	378.050	336.940	446.320	85.377
29.	10.936	35.173	71.107	81.006	85.313	183.420	220.120	202.130	226.690	382.200	339.000	445.620	86.007
30.	11.061	27.593	69.945	79.444	82.862	184.590	221.590	203.840	227.140	385.360	340.470	444.860	86.655
31.	11.214	32.367	67.250	74.725	78.082	180.390	219.310	200.220	223.740	388.910	341.850	443.770	86.989
32.	11.949	39.942	86.898	107.850	109.920	212.360	247.290	231.450	252.640	402.100	345.400	436.830	90.038
33.	12.075	30.240	85.792	109.280	112.200	212.490	247.910	230.910	250.380	403.770	345.440	435.500	91.782
34.	12.227	34.799	78.823	94.595	98.571	203.160	240.330	222.450	242.020	405.600	345.400	433.690	93.075
35.	12.966	41.957	93.942	115.340	118.720	218.780	252.360	236.950	253.840	411.940	343.820	424.870	98.186

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITHOUT EXPLOSAFE - FILE NAME : TEST 15

DATE OF TEST : JAN 10, 1984 Q IN = 65 KW/M SQ LIQUID LEVEL = 23 PERCENT

SET PRESSURE = 35 PSIG PRV ORIFICE DIAMETER = 1/4 INCHES

	TIME MINS	PRESSURE PSIG	THRM034 C	THRM035 C	THRM036 C	THRM037 C	THRM038 C	THRM039 C	THRM040 C	THRM041 C	THRM042 C	THRM043 C
1.	0.139	3.386	21.479	20.955	19.965	19.946	21.110	22.022	2.475	21.731	21.440	21.304
2.	0.630	4.490	24.239	23.814	19.975	21.392	22.497	22.032	2.474	21.722	21.412	21.315
3.	1.213	5.655	33.110	31.247	19.966	23.882	27.012	22.062	2.473	21.732	21.403	21.306
4.	1.804	6.836	44.865	41.536	20.039	25.946	34.064	22.057	2.471	21.708	21.437	21.320
5.	2.403	8.082	59.351	55.868	20.456	28.982	43.657	22.163	2.472	21.795	21.581	21.465
6.	3.012	9.577	76.402	72.452	21.090	31.552	55.804	22.311	2.471	21.923	21.885	21.749
7.	3.618	11.425	95.213	89.305	22.228	34.041	70.206	22.615	2.470	22.228	22.460	22.305
8.	4.244	13.754	116.410	107.370	23.502	36.533	87.507	23.095	2.470	22.727	23.289	23.153
9.	4.868	16.877	138.760	123.170	25.123	43.828	106.870	23.828	2.470	23.441	24.505	24.369
10.	5.504	20.594	162.500	139.240	30.962	48.970	128.690	24.832	2.470	24.484	26.107	26.011
11.	6.164	25.295	187.560	153.430	41.464	53.619	150.190	26.182	2.469	25.892	28.265	28.168
12.	6.850	31.138	213.860	165.190	52.277	59.251	180.200	27.955	2.469	27.724	31.035	30.900
13.	7.557	38.245	243.180	175.610	59.099	64.674	203.130	30.206	2.469	30.110	34.410	34.276
14.	7.683	30.004	248.720	168.170	59.570	60.434	196.170	30.649	2.469	30.572	35.063	34.929
15.	7.835	33.132	249.650	164.050	58.046	61.054	179.870	31.207	2.469	31.168	35.867	35.714
16.	8.587	43.036	273.850	178.250	64.395	67.990	192.370	34.240	2.469	34.508	40.376	40.090
17.	8.713	35.564	277.730	174.620	64.507	64.526	191.470	34.796	2.469	35.121	41.196	40.891
18.	8.808	32.053	278.670	171.010	62.012	61.749	184.060	35.254	2.469	35.580	41.805	41.500
19.	8.964	36.930	280.040	172.810	61.356	63.551	181.770	35.964	2.469	36.365	42.815	42.472
20.	9.092	31.044	284.510	171.750	61.579	60.941	182.560	36.593	2.469	37.052	43.707	43.326
21.	9.248	36.024	288.430	174.380	60.791	62.913	184.290	37.359	2.469	37.856	44.772	44.354
22.	9.376	30.214	293.610	173.190	60.961	60.341	186.640	38.010	2.469	38.583	45.685	45.248
23.	9.531	35.345	297.450	176.910	60.435	62.445	188.820	38.793	2.469	39.461	46.805	46.330
24.	9.660	29.338	302.780	176.390	60.718	59.628	191.920	39.481	2.469	40.225	47.773	47.242
25.	9.815	34.335	305.220	178.430	59.966	61.806	194.350	40.300	2.469	41.101	48.928	48.379
26.	10.560	43.384	323.940	199.010	64.230	67.993	229.320	44.663	2.470	45.917	54.924	54.150
27.	10.688	34.249	324.990	193.290	65.092	63.912	227.660	45.461	2.470	46.771	55.998	55.169
28.	10.784	29.974	322.440	187.020	61.701	60.329	216.520	46.053	2.470	47.419	56.755	55.926
29.	10.936	35.173	317.970	185.200	60.329	62.207	210.000	46.982	2.470	48.423	57.997	57.094
30.	11.061	27.593	318.770	182.690	59.991	58.506	210.290	47.798	2.470	49.314	59.089	58.129
31.	11.214	32.367	317.560	181.830	58.977	59.992	209.300	48.765	2.470	50.376	60.349	59.353
32.	11.949	39.942	326.730	199.930	60.408	65.661	238.180	53.647	2.470	55.628	66.560	65.324
33.	12.075	30.240	326.770	194.960	62.476	60.843	236.310	54.461	2.471	56.535	67.609	66.318
34.	12.227	34.799	322.810	187.530	60.580	62.139	226.980	55.424	2.471	57.571	68.844	67.461
35.	12.966	41.957	325.020	200.140	61.487	67.035	241.520	60.097	2.471	62.651	74.559	73.012

PLOTS OF A TEST

CARRIED OUT ON THE UNB TANK 2

WITHOUT EXPLOSAFE

TEST NUMBER 16

Q in = 65 kW/m sq

LIQUID LEVEL = 76 %

SET PRESSURE = 35 psig

PRV ORIFICE DIAMETER = 3/8 in.

Date of Test FEB 01, 1984

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   (a) Plots of Temperature Vs Time - - - - - - - -
   (b) Plots of Height Vs. Temperature - - - - - - -

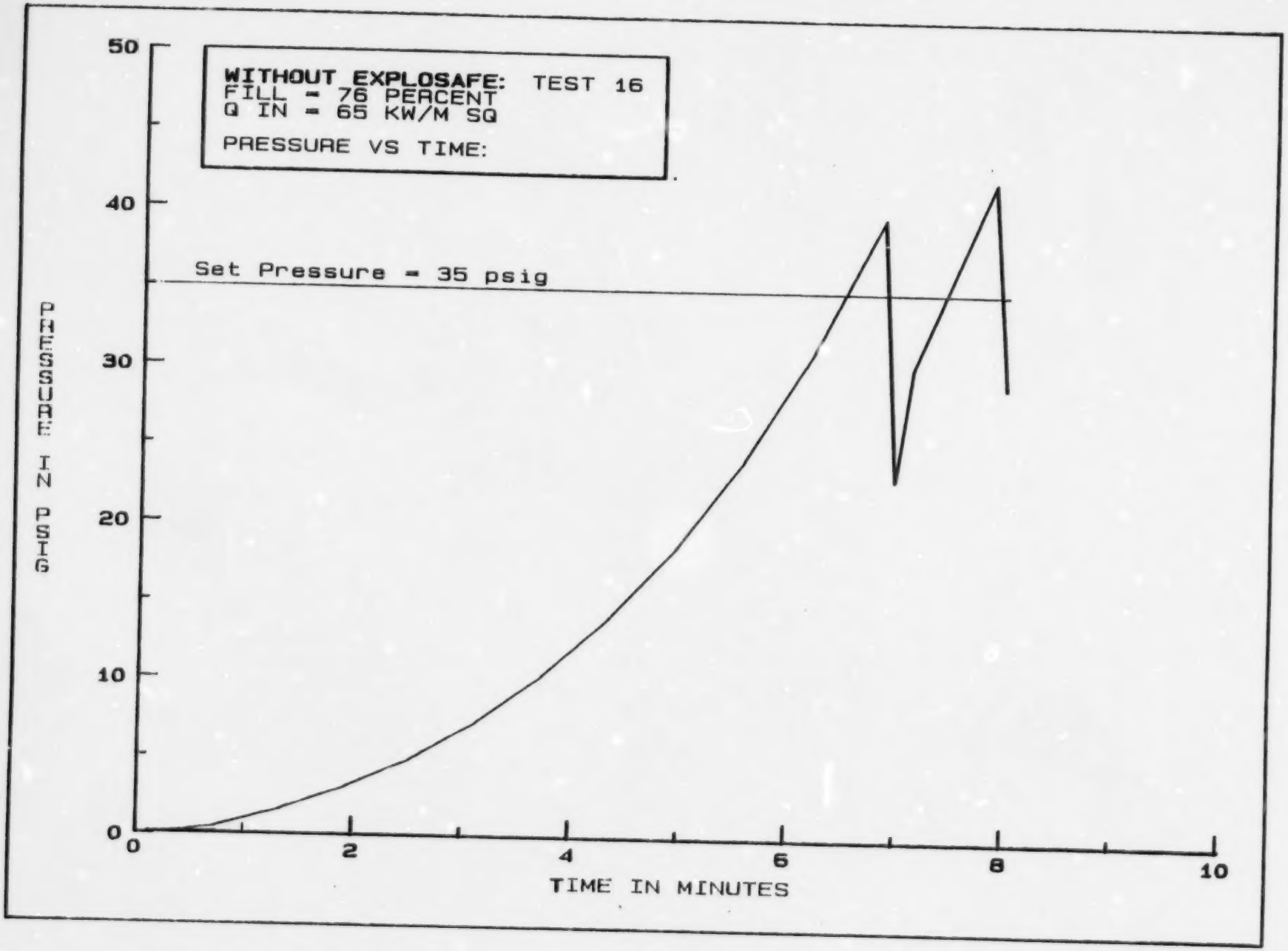
2. Thermocouples Placed in the Four Quadrants
   in a Vertical Plane: Temp. Vs. Time - - - - - -

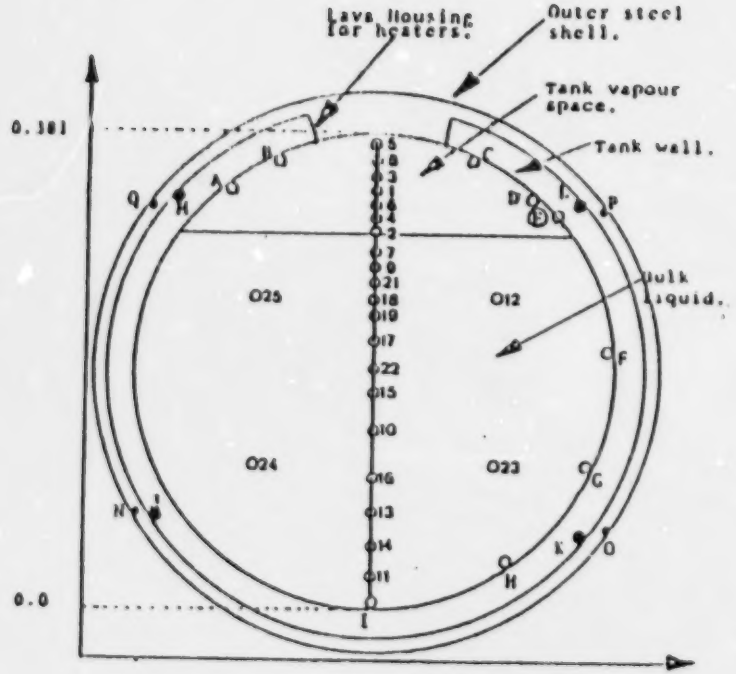
Thermocouple Grid Layout - - - - - - - - - - - -

3. Thermocouples Placed On and Inside the
   Mild Steel Shell: Temp. Vs. Time - - - - - - -

4. Thermocouples Placed in the Lava Medium
   Temp. Vs. Time - - - - - - - - - - - - - - - -

6. Print out of Data - - - - - - - - - - - - - -


WITHOUT EXPLOSAFE: TEST 16
FILL = 76 PERCENT
Q IN = 65 KW/M SQ
PRESSURE VS TIME:
Set Pressure = 35 psig
PRESSURE IN PSIG
TIME IN MINUTES
0
10
20
30
40
50
0
2
4
6
8
10



SYMBOL	Thermocouple #	Angle(Deg)
A	28	310
B & C	37 & 29	340 & 22
D & E	36 & 34	55 & 56
F & G	27 & 38	92 & 116
H & I	35 & 26	144 & 180
J & K	30 & 31	133 & 220
L & M	32 & 33	50 & 300
N & O	42 & 43	140 & 230
P & Q	39 & 41	60 & 310

Number 45 represents time in seconds.
Number 44 represents pressure in psig.
Reference upper diameter = 48.37 cms.

Thermocouple numbers.	Height (cm)	Angle with the vertical (Deg.)	Doubtful or faulty Thermocouple.
05	45.88	-	-
08	44.90S	-	-
03	43.63	-	YES
01	42.71S	-	-
06	41.80S	-	-
04	40.74S	-	-
02	39.88S	-	-
07	37.76S	-	-
09	36.84S	-	-
21	35.70S	-	-
18	34.84	-	-
19	33.86	-	YES
17	31.72	-	-
22	29.63S	-	-
15	27.66S	-	-
10	25.58S	-	-
16	24.58S	-	-
13	21.02	-	-
14	16.94	-	-
11	12.81	-	-
26	10.25S	180	-
29 & 36	-	22 & 55	-
28 & 37	-	310 & 340	-
27 & 38	-	92 & 116	-
35	-	144	-
30 & 31	-	133 & 220	-
32 & 33	-	50 & 300	-
39 & 41	-	60 & 310	-
42 & 43	-	140 & 230	-
34	-	56	YES
23 & 25	-	-	YES
12	32.20	-	-
24	24.85	-	-
20 & 40	Reference temperature	-	-

○ Circled thermocouple is inserted inside the vapour space wall.

Fig. III.B A grid layout of thermocouples along with their locations for an unprotected vessel(UNB) with the PRV orifice of 3/8 in. (Valid for 76, 58 and 23 percent liquid full cases)

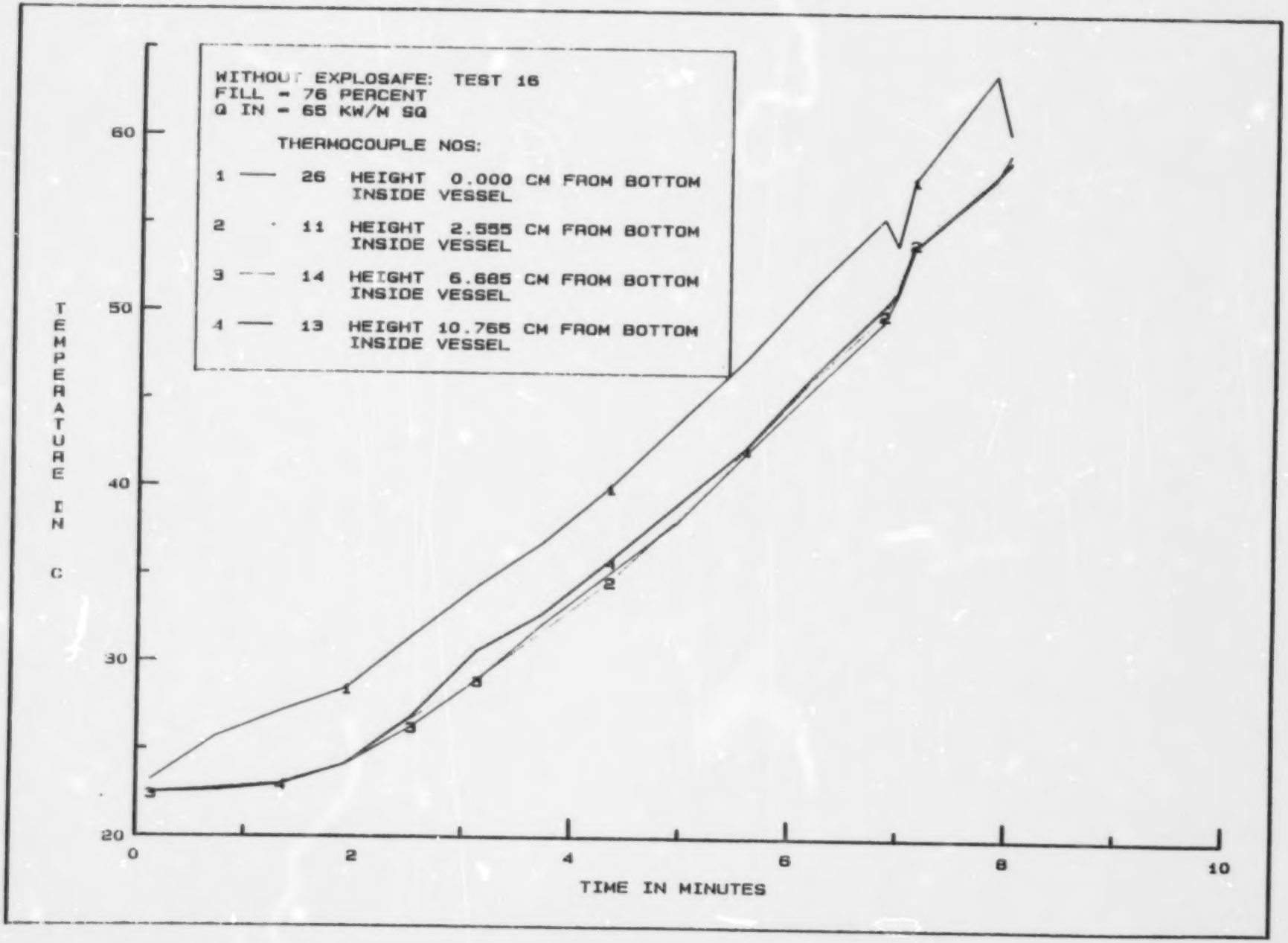
FOLLOWING THERMOCOUPLES ARE PLACED

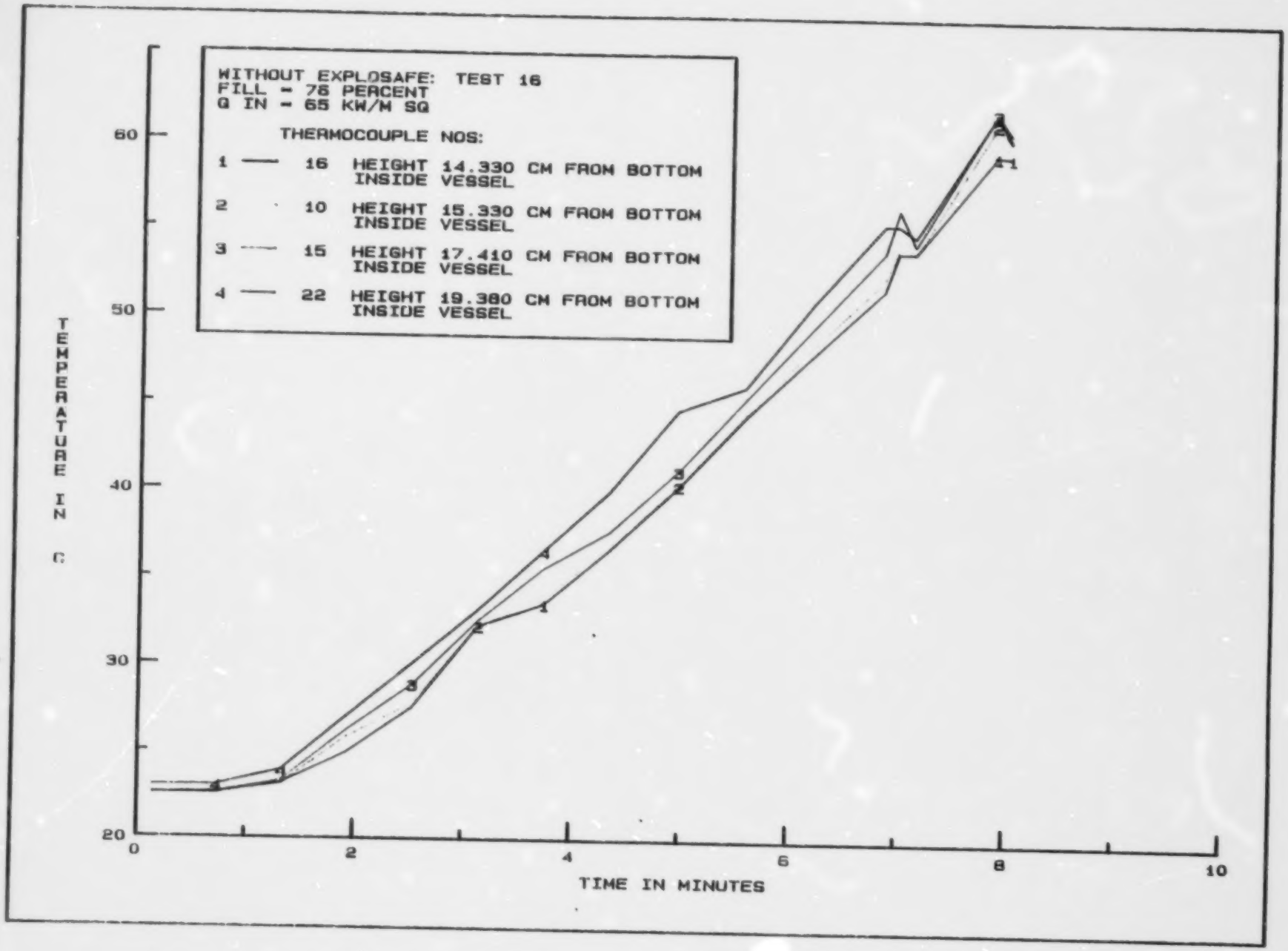
AT THE CENTRE OF THE VESSEL (DIA. 38.1 CM)

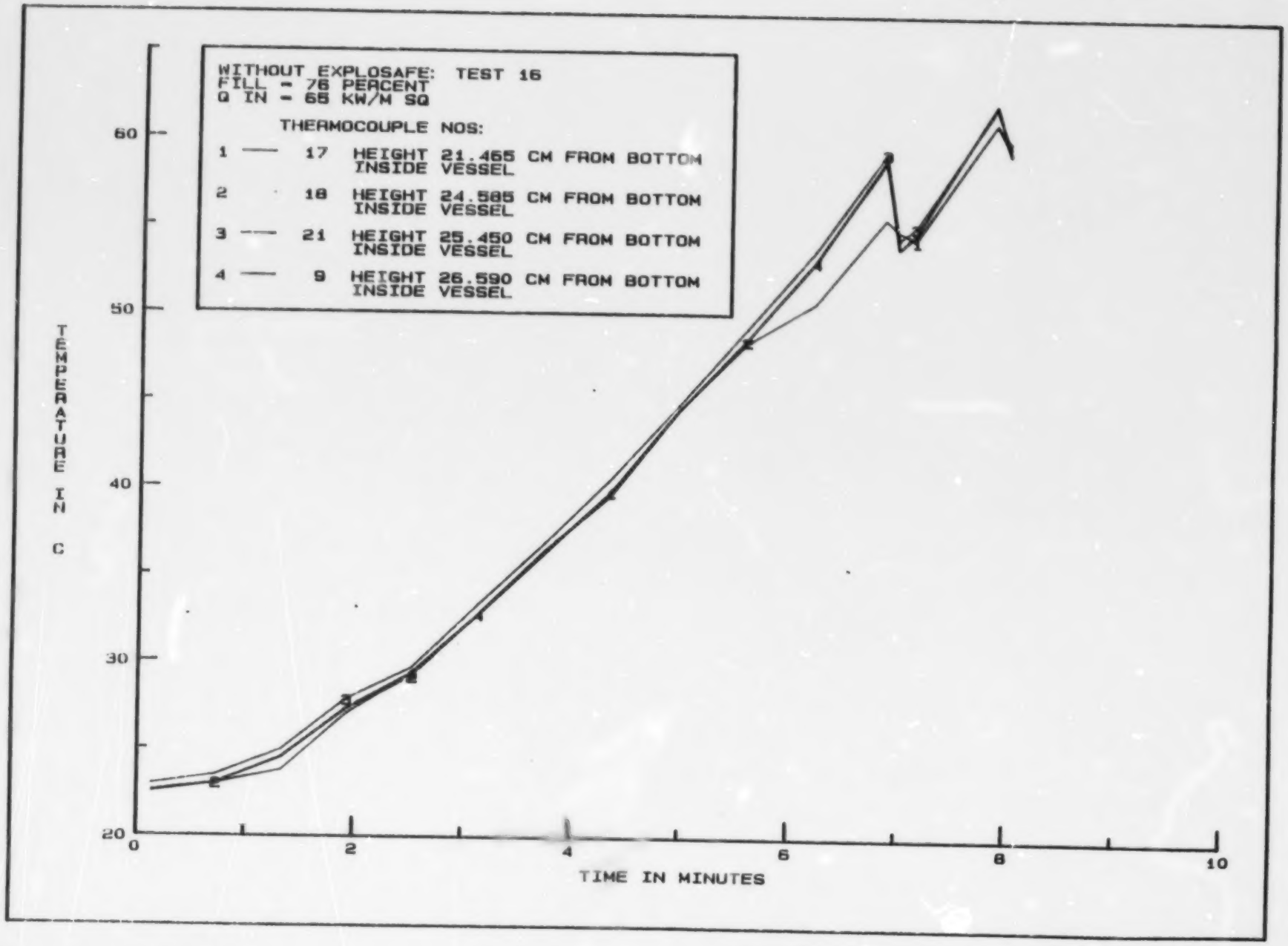
IN A VERTICLE AXIS

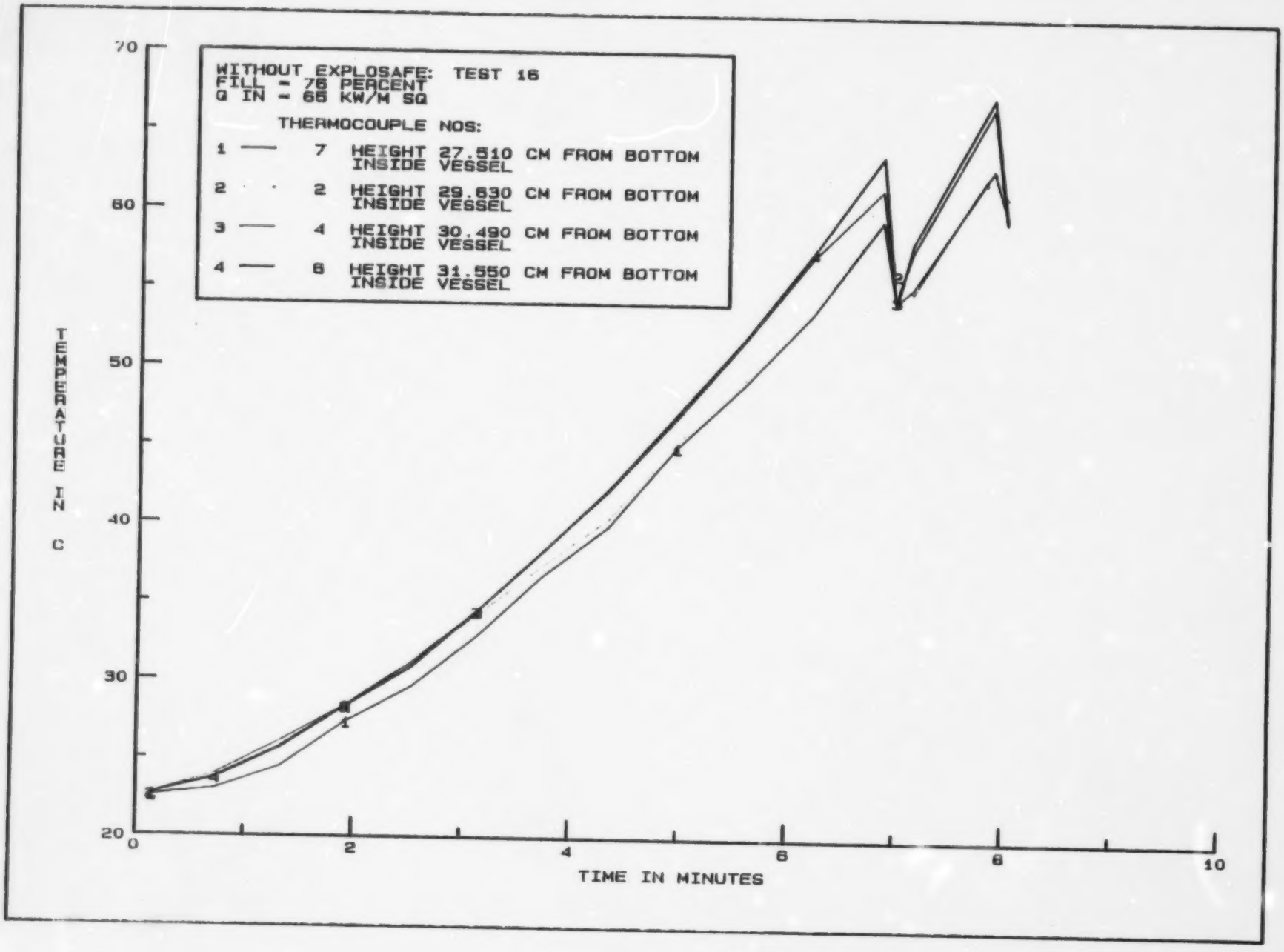
THERMOCOUPLE NUM.	HEIGHT FROM BOTTOM IN cm
28 OR I	0
11	2.555
14	6.685
13	10.765
16	14.33
10	15.33
15	17.41
22	19.38
17	21.465
18	24.585
21	25.45
9	26.59
7	27.51
2	29.63
4	30.49
6	31.55
1	32.46
8	34.65
5	35.625

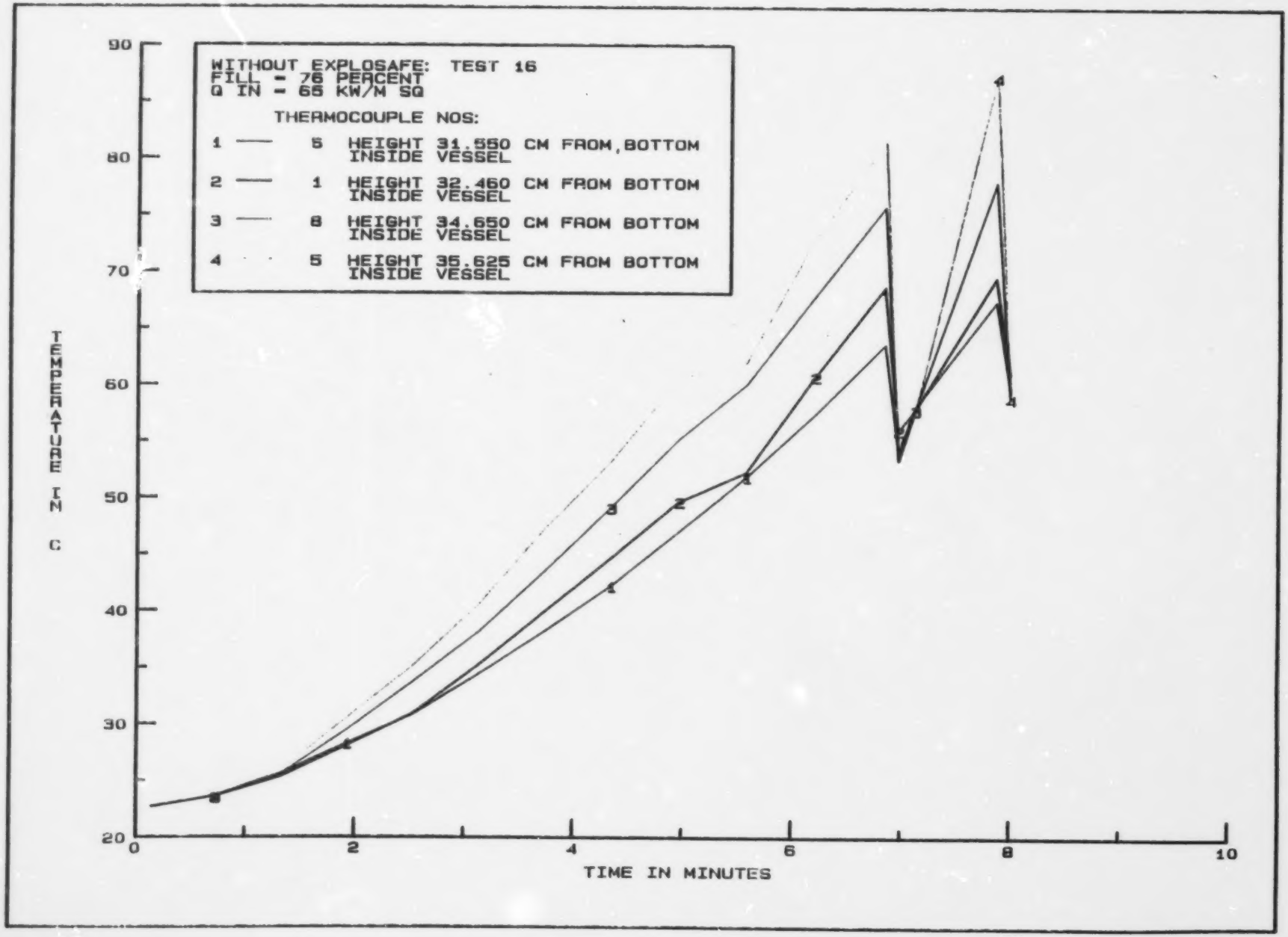
PLOTS ARE GIVEN PER PAGE


WITHOUT EXPLOSAFE: TEST 16
FILL - 76 PERCENT
Q IN - 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 26 HEIGHT 0.000 CM FROM BOTTOM INSIDE VESSEL
2 11 HEIGHT 2.555 CM FROM BOTTOM INSIDE VESSEL
3 —— 14 HEIGHT 6.665 CM FROM BOTTOM INSIDE VESSEL
4 —— 13 HEIGHT 10.765 CM FROM BOTTOM INSIDE VESSEL
TEMPERATURE IN C
60
50
40
30
20
0
2
4
6
8
10
TIME IN MINUTES


WITHOUT EXPLOSAFE: TEST 16
FILL - 75 PERCENT
Q IN - 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 16 HEIGHT 14.330 CM FROM BOTTOM INSIDE VESSEL
2 10 HEIGHT 15.330 CM FROM BOTTOM INSIDE VESSEL
3 —— 15 HEIGHT 17.410 CM FROM BOTTOM INSIDE VESSEL
4 —— 22 HEIGHT 19.380 CM FROM BOTTOM INSIDE VESSEL
TEMPERATURE IN C
60
50
40
30
20
0
2
4
6
8
10
TIME IN MINUTES


WITHOUT EXPLOSAFE: TEST 16
FILL - 76 PERCENT
Q IN - 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 17 HEIGHT 21.465 CM FROM BOTTOM INSIDE VESSEL
2 —— 18 HEIGHT 24.585 CM FROM BOTTOM INSIDE VESSEL
3 —— 21 HEIGHT 25.450 CM FROM BOTTOM INSIDE VESSEL
4 —— 9 HEIGHT 26.590 CM FROM BOTTOM INSIDE VESSEL
TEMPERATURE IN C
60
50
40
30
20
0
2
4
6
8
10
TIME IN MINUTES


WITHOUT EXPLOSAFE: TEST 16
FILL = 76 PERCENT
Q IN = 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 7 HEIGHT 27.510 CM FROM BOTTOM INSIDE VESSEL
2 —— 2 HEIGHT 29.630 CM FROM BOTTOM INSIDE VESSEL
3 —— 4 HEIGHT 30.490 CM FROM BOTTOM INSIDE VESSEL
4 —— 6 HEIGHT 31.550 CM FROM BOTTOM INSIDE VESSEL
TEMPERATURE IN C
70
60
50
40
30
20
0
2
4
6
8
10
TIME IN MINUTES


WITHOUT EXPLOSAFE: TEST 16
FILL = 76 PERCENT
Q IN = 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 5 HEIGHT 31.550 CM FROM BOTTOM INSIDE VESSEL
2 —— 1 HEIGHT 32.460 CM FROM BOTTOM INSIDE VESSEL
3 —— 8 HEIGHT 34.650 CM FROM BOTTOM INSIDE VESSEL
4 —— 5 HEIGHT 35.625 CM FROM BOTTOM INSIDE VESSEL
TEMPERATURE IN C
90
80
70
60
50
40
30
20
0
2
4
6
8
10
TIME IN MINUTES

FOLLOWING ARE HEIGHT VS TEMPERATURE

PLOTS FOR THE

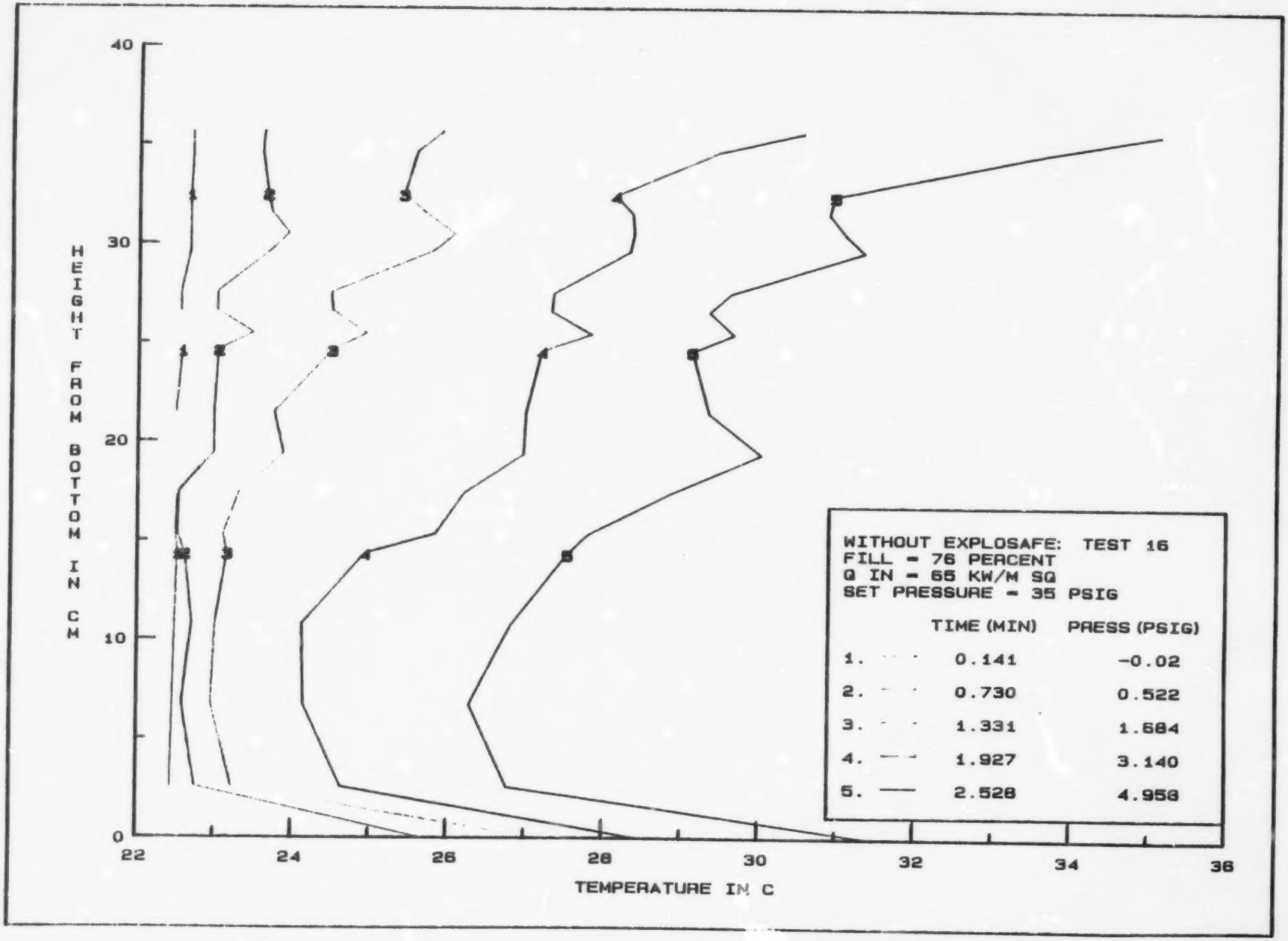
THERMOCOUPLES PLACED AT THE CENTRE

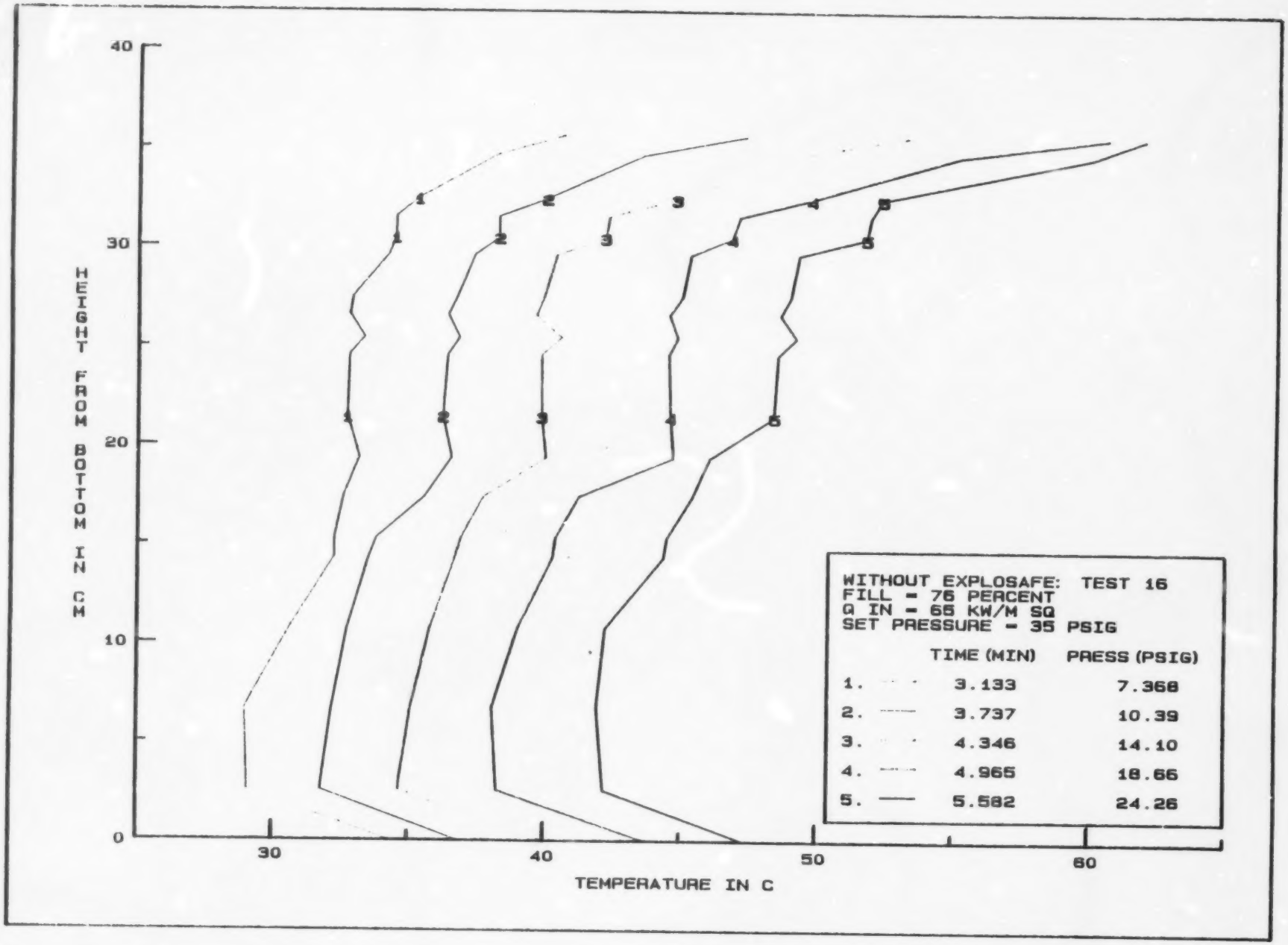
OF THE VESSEL

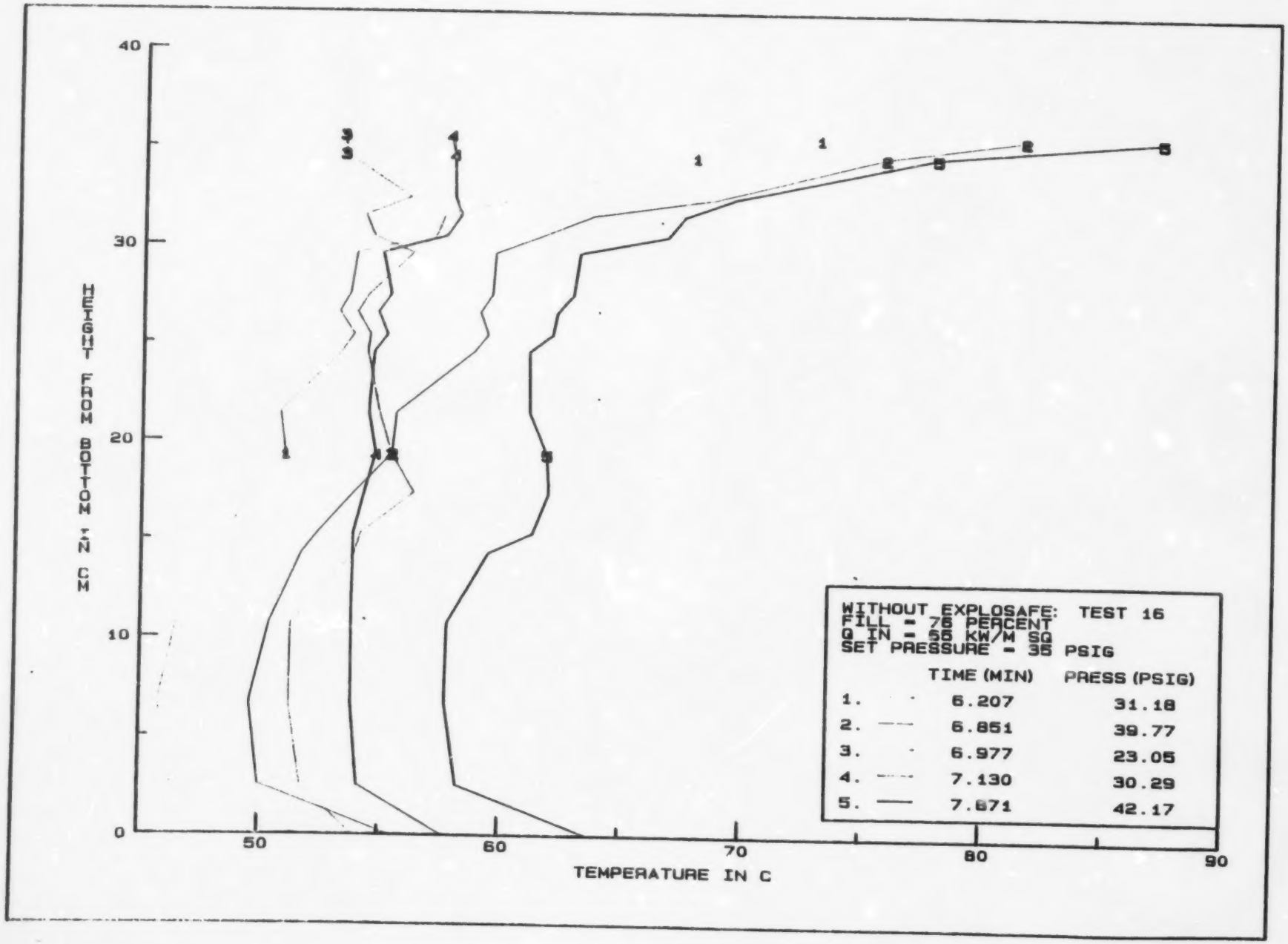
IN A VERTICAL AXIS.

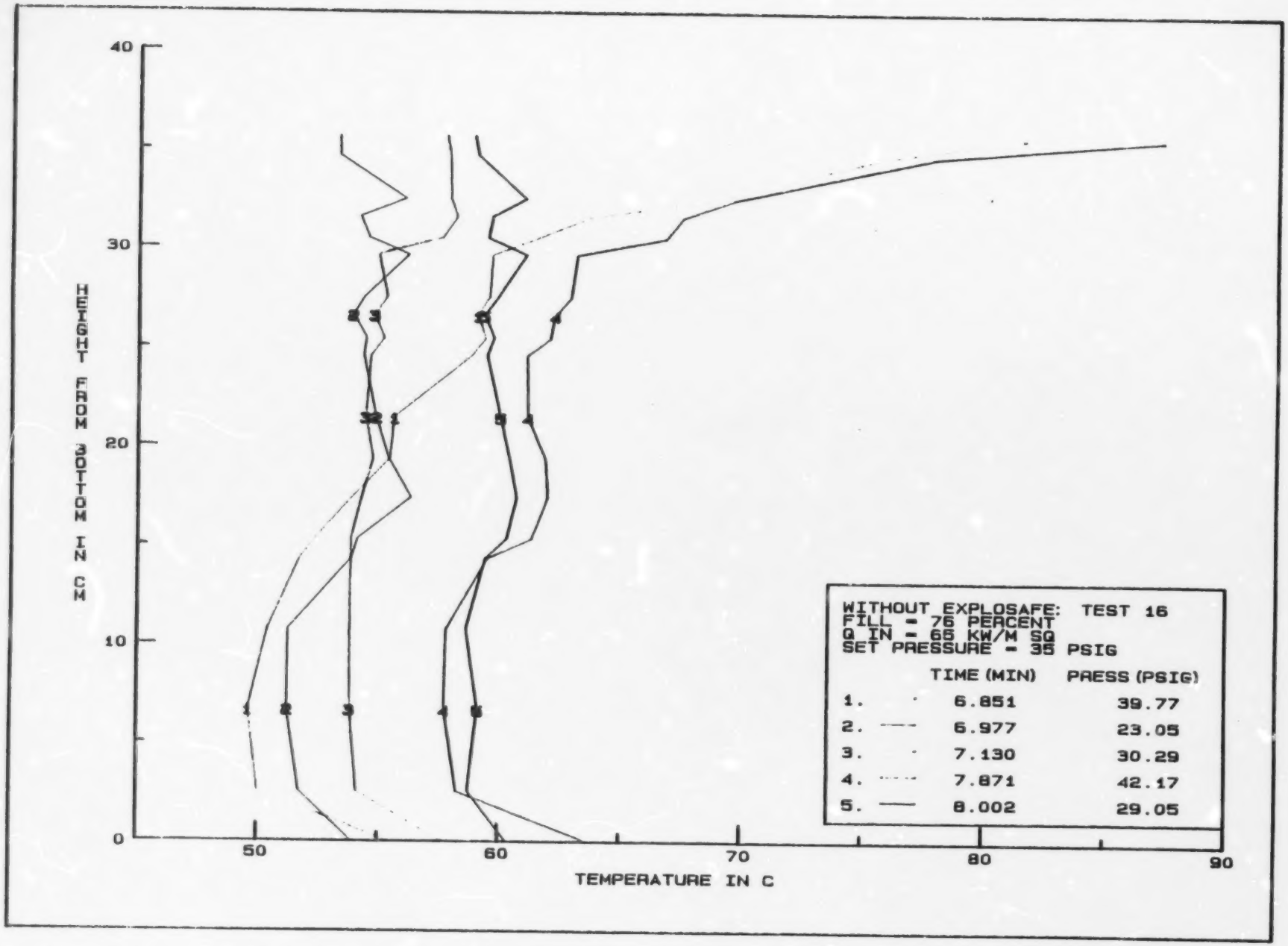
* EACH PLOT REPRESENTS ONE SCAN OF ALL THE THERMOCOUPLES

* PLOTS ARE GIVEN AS FIVE (5) SCANS PER PAGE


HEIGHT FROM BOTTOM IN CM
0
10
20
30
40
22
24
26
28
30
32
34
36
TEMPERATURE IN C
WITHOUT EXPLOSAFE: TEST 16
FILL = 76 PERCENT
Q IN = 65 KW/M SQ
SET PRESSURE = 35 PSIG
TIME (MIN) PRESS (PSIG)
1. 0.141 -0.02
2. 0.730 0.522
3. 1.331 1.684
4. 1.927 3.140
5. 2.528 4.958

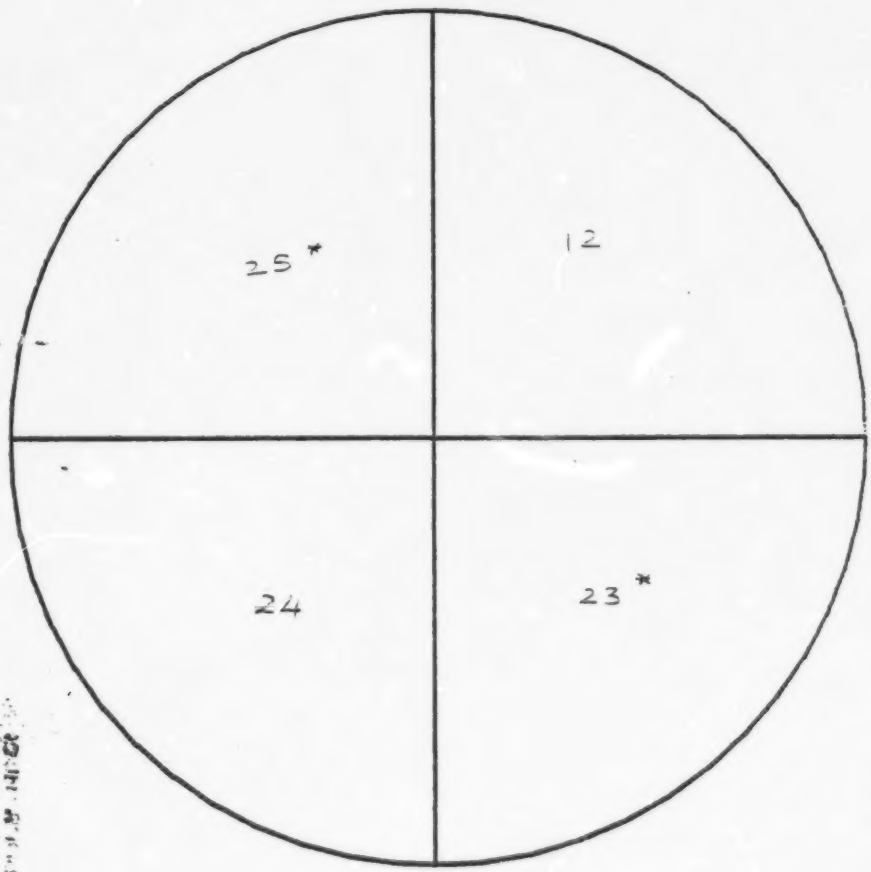

HEIGHT FROM BOTTOM IN CM
40
30
20
10
0
30
40
50
60
TEMPERATURE IN C
WITHOUT EXPLOSAFE: TEST 16
FILL - 76 PERCENT
Q IN - 65 KW/M SQ
SET PRESSURE - 35 PSIG
TIME (MIN) PRESS (PSIG)
1. 3.133 7.368
2. 3.737 10.39
3. 4.346 14.10
4. 4.965 18.66
5. 5.582 24.26


HEIGHT FROM BOTTOM IN CM
40
30
20
10
0
50
60
70
80
90
TEMPERATURE IN C
WITHOUT EXPLOSAFE: TEST 16
FILL - 76 PERCENT
Q IN - 55 KW/M SQ
SET PRESSURE - 35 PSIG
TIME (MIN) PRESS (PSIG)
1. 6.207 31.18
2. 6.851 39.77
3. 6.977 23.05
4. 7.130 30.29
5. 7.671 42.17


HEIGHT FROM BOTTOM IN CM
40
30
20
10
0
50
60
70
80
90
TEMPERATURE IN C
WITHOUT EXPLOSAFE: TEST 16
FILL = 76 PERCENT
Q IN = 65 KW/M SQ
SET PRESSURE = 35 PSIG
TIME (MIN) PRESS (PSIG)
1. 6.851 39.77
2. 6.977 23.05
3. 7.130 30.29
4. 7.871 42.17
5. 8.002 29.05

FOLLOWING FOUR THERMOCOUPLES ARE PLACED

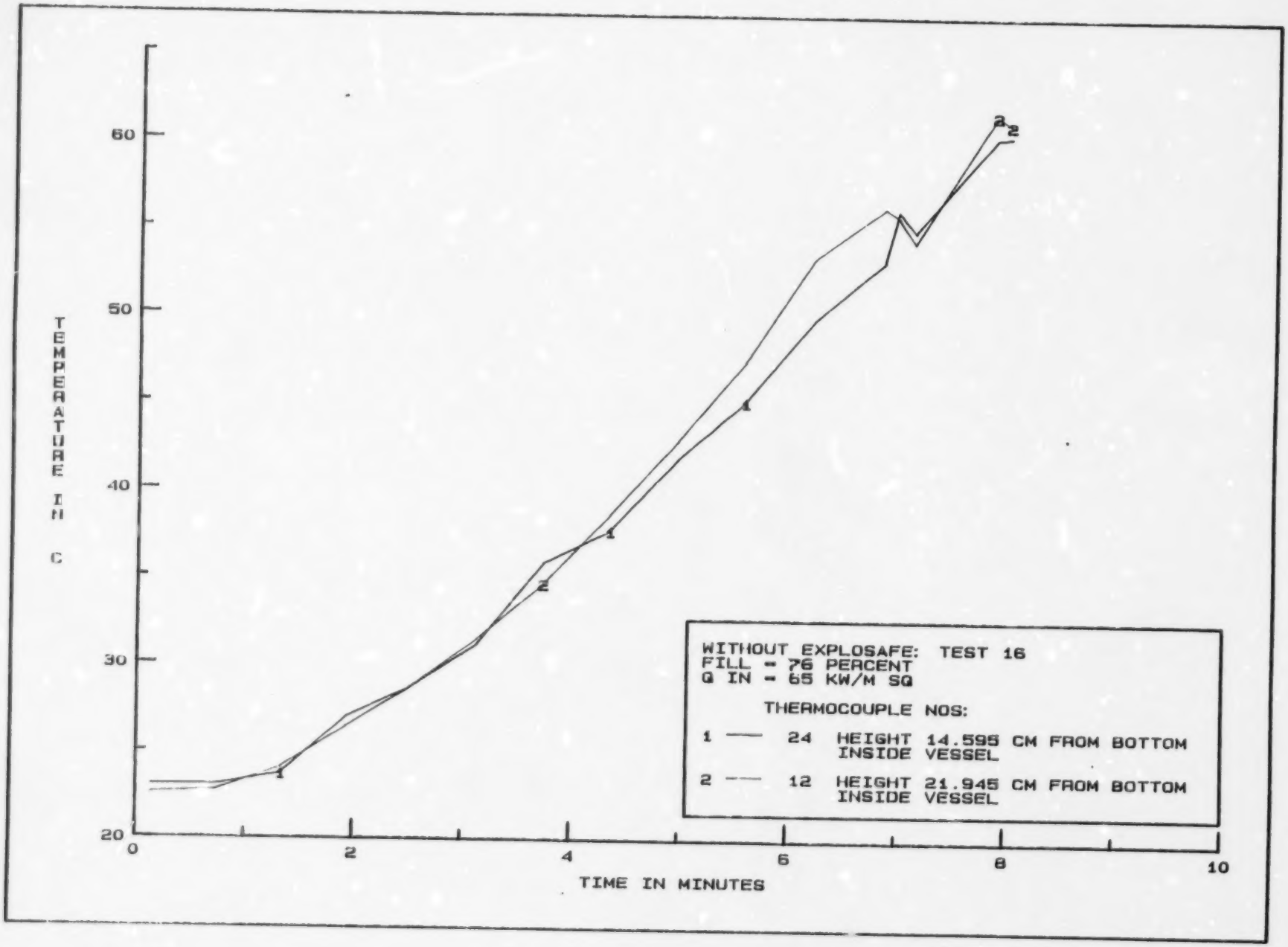
AT THE FOUR QUADRANTS ON A VERTICAL PLANE

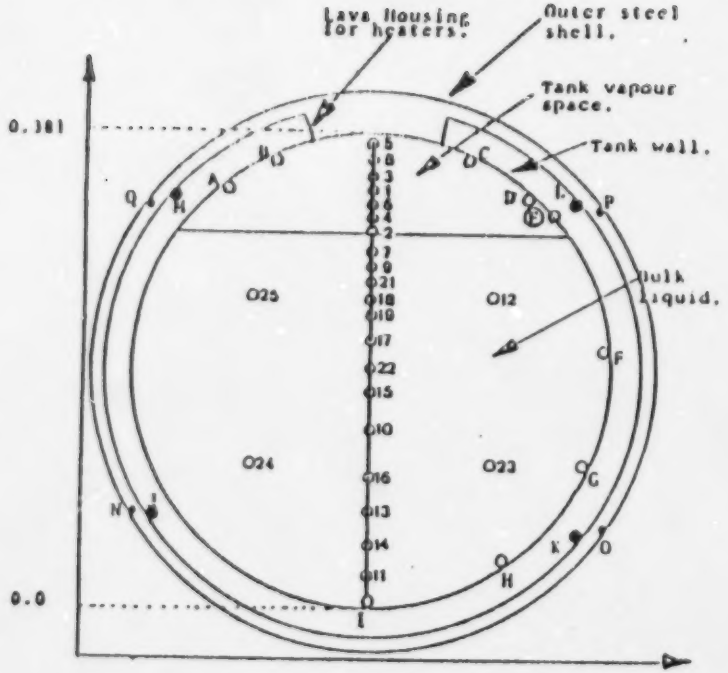


THERMOCOUPLE NUM.	HEIGHT FROM BOTTOM IN cm
24 AND 23	14.595
25 AND 12	21.945

PLOTS ARE GIVEN TWO PER PAGE

*** Thermocouple Nos. 23 and 25 were FAULTY during experiment ***


TEMPERATURE IN C
60
50
40
30
20
0
2
4
6
8
10
TIME IN MINUTES
WITHOUT EXPLOSAFE: TEST 16
FILL - 76 PERCENT
Q IN - 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 24 HEIGHT 14.595 CM FROM BOTTOM INSIDE VESSEL
2 —— 12 HEIGHT 21.945 CM FROM BOTTOM INSIDE VESSEL



SYMBOL	Thermocouple #	Angle(Deg)
A	28	310
B & C	37 & 29	340 & 22
D & E	36 & 34	55 & 56
F & G	27 & 38	92 & 116
H & I	35 & 26	144 & 180
J & K	30 & 31	133 & 220
L & M	32 & 33	50 & 300
N & O	42 & 43	140 & 230
P & Q	39 & 41	60 & 310

○ Circled thermocouple is inserted inside the vapour space wall.

Number 45 represents time in seconds.
Number 44 represents pressure in psig.
Reference upper diameter = 48.37 cms.

Thermocouple numbers.	Height (cm)	Angle with the vertical (Deg.)	Doubtful or faulty Thermocouple.
05	45.88	-	-
08	44.90S	-	-
03	43.63	-	YES
01	42.71S	-	-
06	41.80S	-	-
04	40.74S	-	-
02	39.88S	-	-
07	37.76S	-	-
09	36.84S	-	-
21	35.70S	-	-
18	34.84	-	-
19	33.86	-	YES
17	31.72	-	-
22	29.63S	-	-
15	27.66S	-	-
10	25.56S	-	-
16	24.58S	-	-
13	21.02	-	-
14	16.94	-	-
11	12.81	-	-
26	10.25S	180	-
29 & 36	-	22 & 55	-
28 & 37	-	310 & 340	-
27 & 38	-	92 & 116	-
35	-	144	-
30 & 31	-	133 & 220	-
32 & 33	-	50 & 309	-
39 & 41	-	60 & 310	-
42 & 43	-	140 & 230	-
34	-	56	YES
23 & 25	-	-	YES
12	32.20	-	-
24	24.85	-	-
20 & 40	Reference temperature	-	-

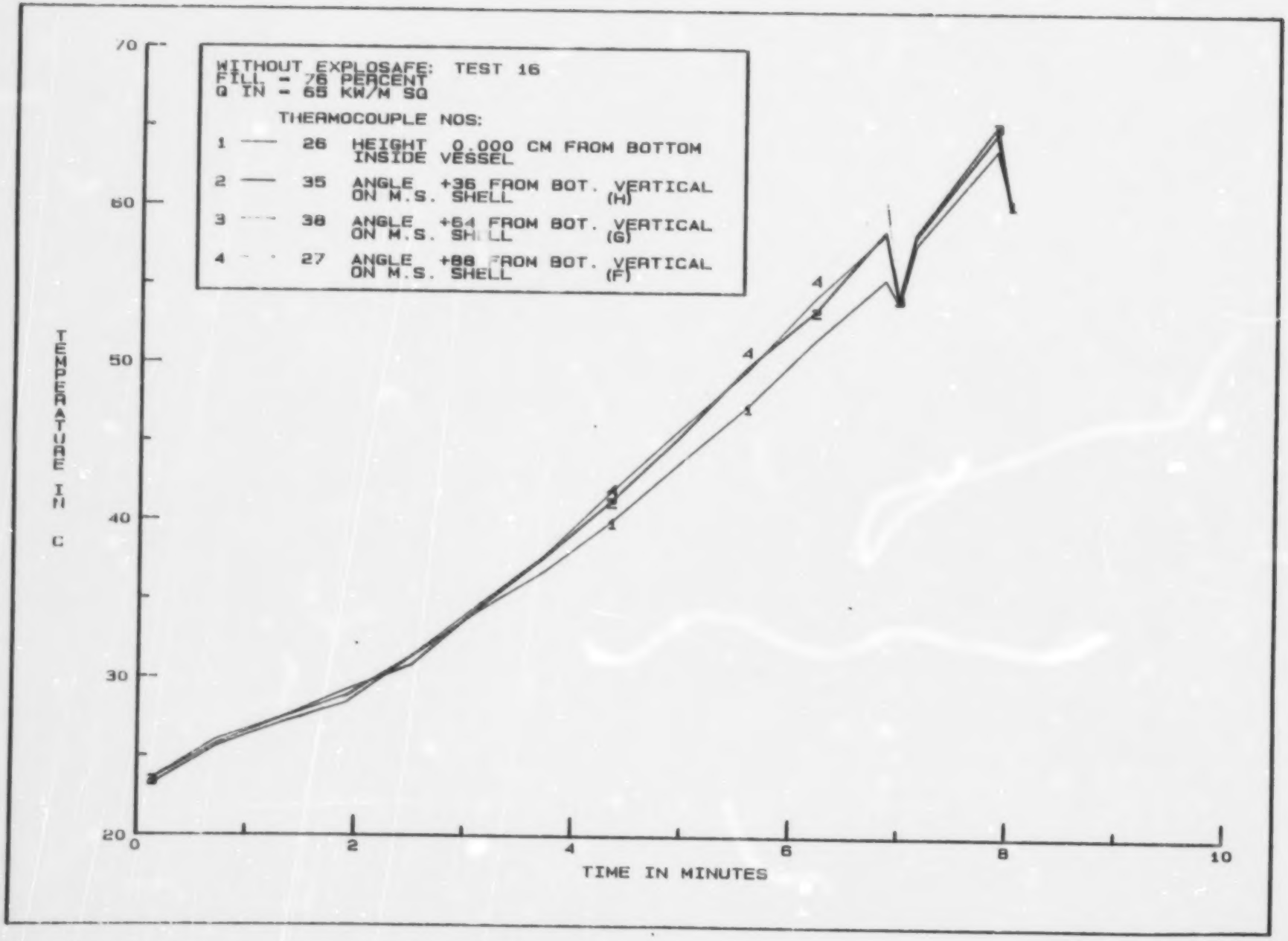
Fig. III.B A grid layout of thermocouples along with their locations for an unprotected vessel(UNB) with the PRV orifice of 3/8 in. (Valid for 76, 58 and 23 percent liquid full cases)

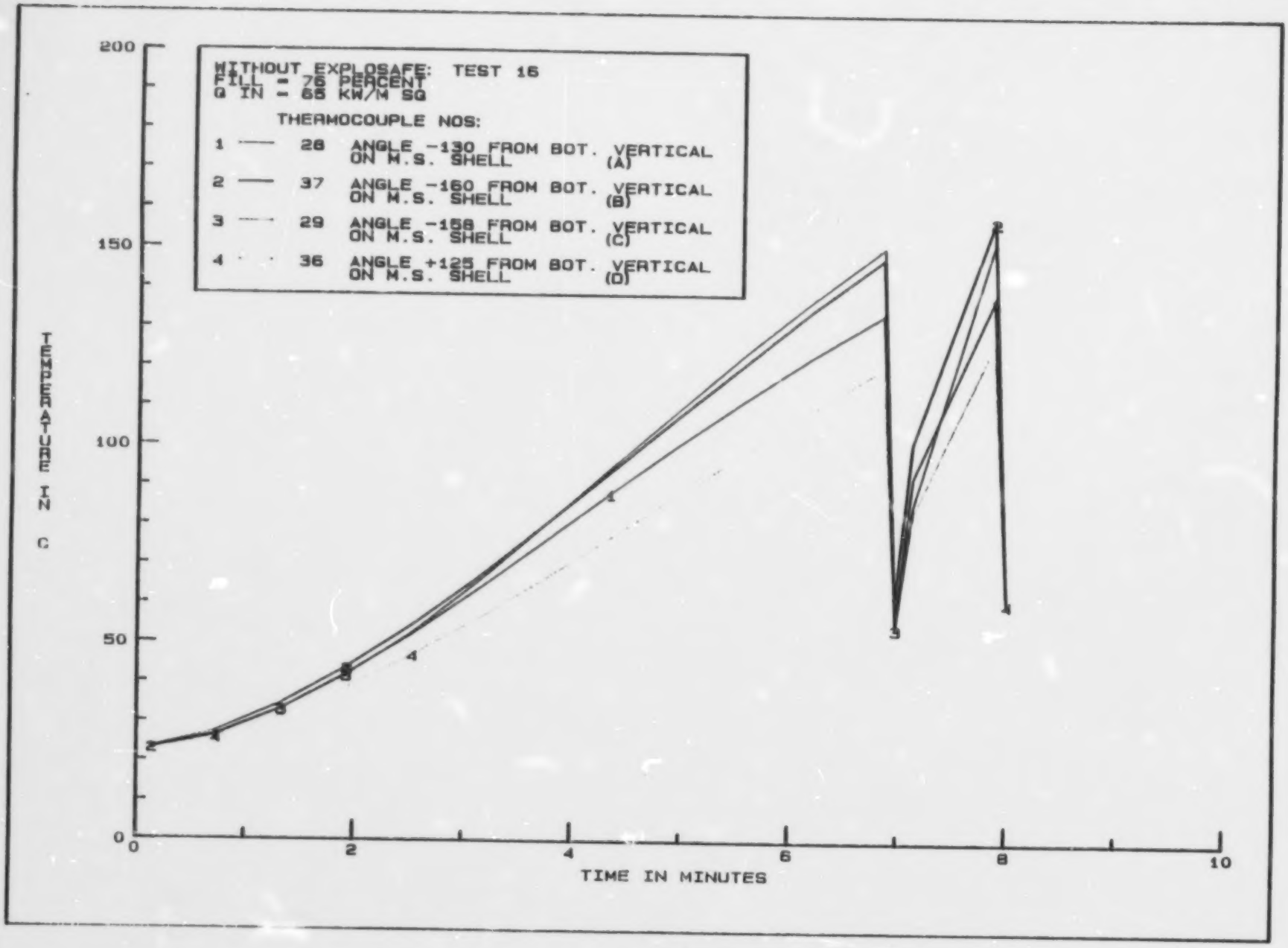
FOLLOWING THERMOCOUPLES ARE PLACED

ON THE MILD STEEL SHELL OR

INSIDE THE MILD STEEL SHELL

THERMOCOUPLE NUM.	ANGLE FROM BOTTOM VERTICAL
ON THE MILD STEEL SHELL:	
26 OR I	00
27 OR F	+88
28 OR A	−130
29 OR C	−158
35 OR H	+36
36 OR D	+125
37 OR B	−160
38 OR G	+64
INSIDE THE MILD STEEL SHELL:	
34 OR E	+124

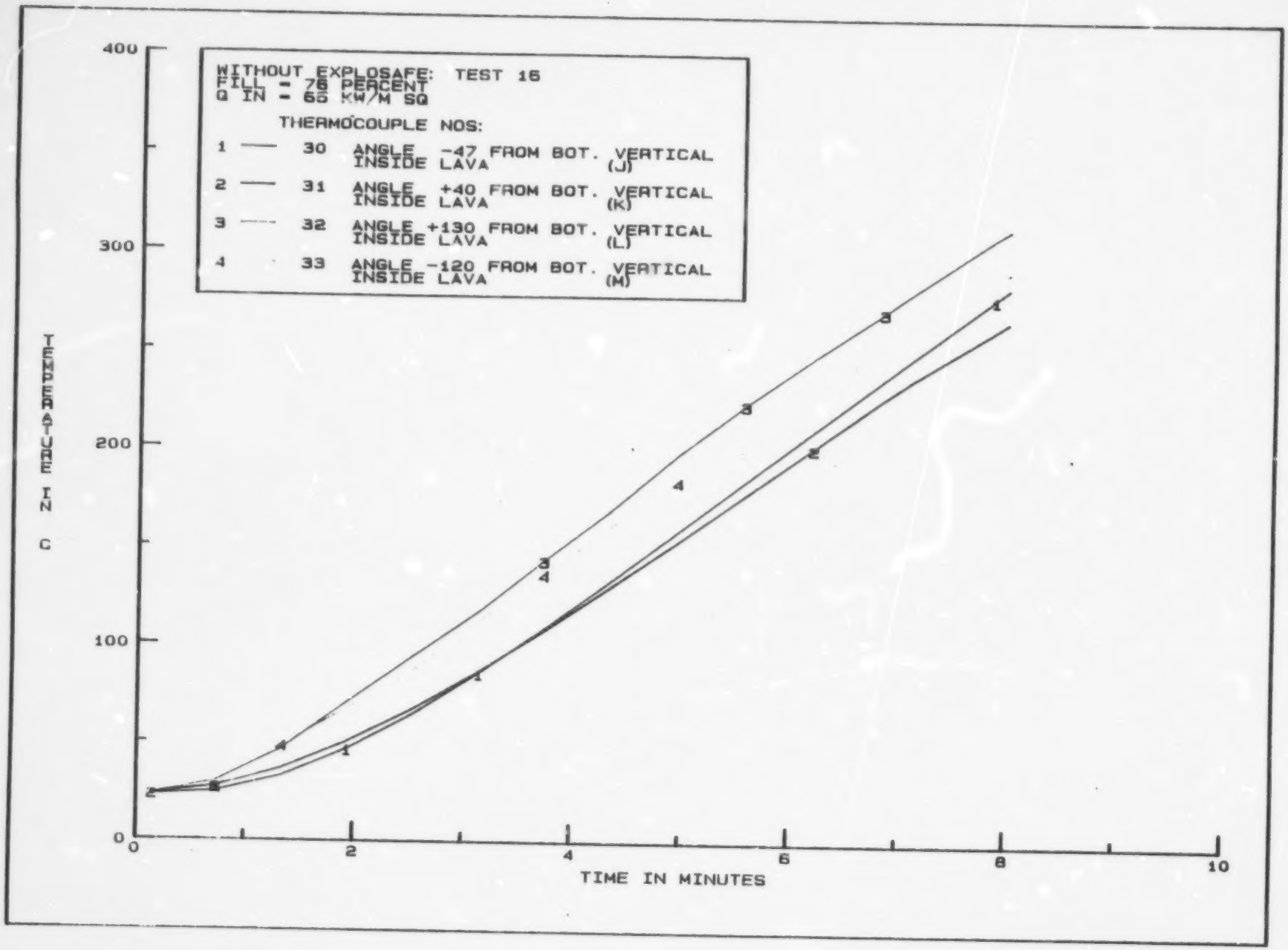

WITHOUT EXPLOSAFE: TEST 16
FILL - 76 PERCENT
Q IN - 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 26 HEIGHT 0.000 CM FROM BOTTOM INSIDE VESSEL
2 —— 35 ANGLE +36 FROM BOT. VERTICAL ON M.S. SHELL (H)
3 —— 38 ANGLE +64 FROM BOT. VERTICAL ON M.S. SHELL (G)
4 — · 27 ANGLE +88 FROM BOT. VERTICAL ON M.S. SHELL (F)
TEMPERATURE IN C
70
60
50
40
30
20
0
2
4
6
8
10
TIME IN MINUTES


WITHOUT EXPLOSAFE: TEST 16
FILL = 76 PERCENT
Q IN = 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 28 ANGLE -130 FROM BOT. VERTICAL ON M.S. SHELL (A)
2 —— 37 ANGLE -160 FROM BOT. VERTICAL ON M.S. SHELL (B)
3 —— 29 ANGLE -158 FROM BOT. VERTICAL ON M.S. SHELL (C)
4 · · 36 ANGLE +125 FROM BOT. VERTICAL ON M.S. SHELL (D)
TEMPERATURE IN C
200
150
100
50
0
0
2
4
6
8
10
TIME IN MINUTES

FOLLOWING THERMOCOUPLES ARE PLACED IN THE LAVA MEDIUM

THERMOCOUPLE NUM.	ANGLE FROM BOTTOM VERTICAL
30 OR J	-47
31 OR K	+40
32 OR L	+130
33 OR M	-120

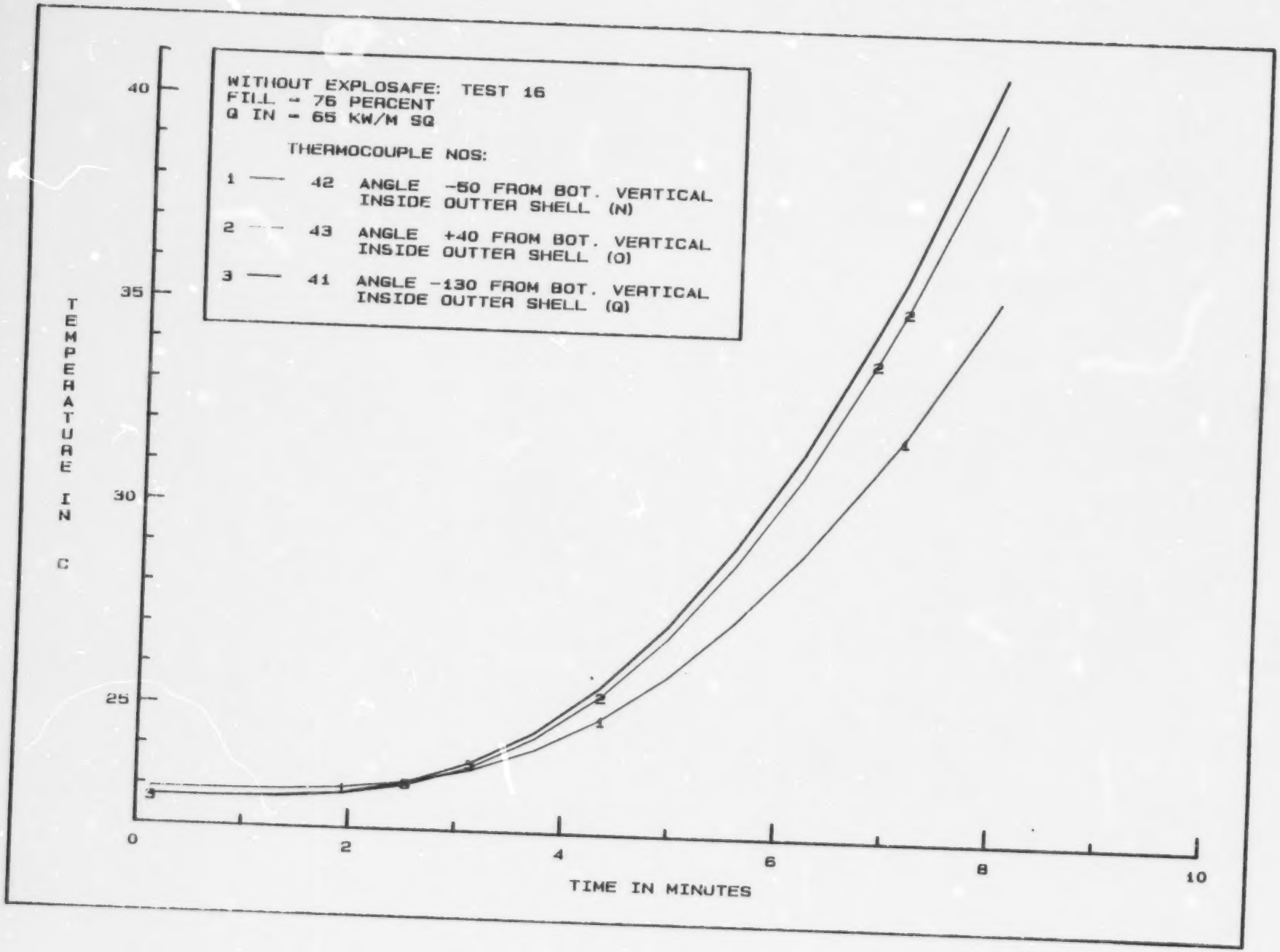
ALL FOUR PLOTS ARE GIVEN ON ONE PAGE


WITHOUT EXPLOSAFE: TEST 16
FILL = 76 PERCENT
Q IN = 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 30 ANGLE -47 FROM BOT. VERTICAL INSIDE LAVA (J)
2 —— 31 ANGLE +40 FROM BOT. VERTICAL INSIDE LAVA (K)
3 —— 32 ANGLE +130 FROM BOT. VERTICAL INSIDE LAVA (L)
4 —— 33 ANGLE -120 FROM BOT. VERTICAL INSIDE LAVA (M)
TEMPERATURE IN C
400
300
200
100
0
0
2
4
6
8
10
TIME IN MINUTES

FOLLOWING THERMOCOUPLES ARE PLACED INSIDE THE OUTTER SHELL

THERMOCOUPLE NUM.	ANGLE FROM BOTTOM VERTICAL
39 OR P	+120
41 OR Q	-130
42 OR N	-50
43 OR O	+40

ALL FOUR PLOTS ARE GIVEN ON ONE PAGE


WITHOUT EXPLOSAFE: TEST 16
FILL - 76 PERCENT
Q IN - 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 42 ANGLE -50 FROM BOT. VERTICAL INSIDE OUTTER SHELL (N)
2 —— 43 ANGLE +40 FROM BOT. VERTICAL INSIDE OUTTER SHELL (O)
3 —— 41 ANGLE -130 FROM BOT. VERTICAL INSIDE OUTTER SHELL (Q)
TEMPERATURE IN C
40
35
30
25
0
2
4
6
8
10
TIME IN MINUTES

TEST 16

WITHOUT EXPLOSAFE

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITHOUT EXPLOSAFE - FILE NAME : TEST 16

DATE OF TEST = FEB 1, 1984 Q IN = 65 KW/M SQ LIQUID LEVEL = 76 PERCENT

SET PRESSURE = 35 PSIG PRV ORIFICE DIAMETER = 3/8 INCHES

	TIME MINS	PRESSURE PSIG	THRM#1 C	THRM#2 C	THRM#3 C	THRM#4 C	THRM#5 C	THRM#6 C	THRM#7 C	THRM#8 C	THRM#9 C	THRM#10 C	THRM#11 C
1.	0.141	-0.026	22.658	22.658	896.730	22.658	22.683	22.658	22.535	22.683	22.535	22.485	22.436
2.	0.730	0.522	23.646	23.697	935.770	23.918	23.597	23.696	23.005	23.572	23.005	22.511	22.758
3.	1.331	1.684	25.395	25.788	*******	26.058	25.886	25.668	24.460	25.567	24.485	23.105	23.228
4.	1.928	3.141	28.113	28.309	*******	28.357	30.526	28.333	27.331	29.431	27.306	25.836	24.632
5.	2.528	4.958	30.942	31.330	*******	31.087	35.125	30.869	29.604	33.678	29.336	27.798	26.771
6.	3.134	7.369	35.269	34.185	*******	34.426	40.584	34.450	32.856	38.125	32.736	32.227	29.044
7.	3.737	10.394	39.988	37.359	*******	38.245	47.276	38.245	36.712	43.504	36.375	33.799	31.767
8.	4.346	14.106	44.736	40.372	*******	42.132	53.233	42.274	39.896	49.154	39.610	36.906	34.622
9.	4.966	18.665	49.716	45.279	*******	46.786	60.585	47.068	44.973	55.157	44.500	40.373	38.249
10.	5.582	24.263	52.328	49.273	*******	51.747	61.958	51.910	48.969	60.014	48.594	44.478	42.181
11.	6.207	31.181	60.771	53.816	*******	57.098	73.029	57.444	53.538	67.861	53.097	48.549	46.342
12.	6.852	39.779	68.721	59.606	*******	61.460	81.577	63.626	59.491	75.776	58.987	52.310	49.979
13.	6.977	23.052	56.017	56.156	*******	54.491	53.239	54.121	54.329	53.262	53.842	54.097	51.705
14.	7.131	30.292	57.861	54.885	*******	57.538	57.677	58.137	55.255	57.815	54.723	53.796	54.074
15.	7.871	42.176	69.537	63.107	*******	66.739	67.305	67.439	62.856	77.913	62.195	61.282	58.233
16.	8.003	29.059	60.984	61.030	*******	59.427	58.831	59.611	59.863	58.991	59.290	60.275	58.716

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITHOUT EXPLOSAFE - FILE NAME : TEST 16

DATE OF TEST = FEB 1, 1984 Q IN = 65 KW/M SQ LIQUID LEVEL = 76 PERCENT

SET PRESSURE = 35 PSIG PRV ORIFICE DIAMETER = 3/8 INCHES

	TIME MINS	PRESSURE PSIG	THRM#12 C	THRM#13 C	THRM#14 C	THRM#15 C	THRM#16 C	THRM#17 C	THRM#18 C	THRM#19 C	THRM#20 C	THRM#21 C	THRM#22 C
1.	0.141	-0.026	22.559	22.485	22.460	22.510	22.510	22.485	22.559	891.730	2.713	22.930	22.930
2.	0.730	0.522	22.733	22.709	22.585	22.536	22.610	22.980	23.030	912.770	2.714	23.474	22.980
3.	1.331	1.684	24.091	23.006	22.957	23.302	23.154	23.746	24.485	965.810	2.714	24.928	23.869
4.	1.928	3.141	26.425	24.115	24.139	26.204	24.927	26.988	27.184	*******	2.714	27.820	26.964
5.	2.528	4.958	28.727	26.820	26.280	28.848	27.530	29.336	29.117	*******	2.714	29.653	30.018
6.	3.134	7.369	31.500	30.602	28.946	32.542	32.227	32.663	32.736	*******	2.714	33.292	33.122
7.	3.737	10.394	34.667	32.736	32.179	35.558	33.509	36.207	36.375	*******	2.714	36.808	36.544
8.	4.346	14.106	38.654	35.778	35.080	37.721	36.690	39.824	39.800	*******	2.714	40.539	39.991
9.	4.966	18.665	42.939	39.014	38.057	41.230	40.278	44.548	44.477	*******	2.714	44.807	44.666
10.	5.582	24.263	47.469	42.229	41.920	45.398	44.360	48.383	48.524	*******	2.715	49.180	46.034
11.	6.207	31.181	53.399	46.483	45.754	49.579	48.010	50.700	53.236	*******	2.715	53.724	50.933
12.	6.852	39.779	56.294	50.376	49.559	53.842	51.682	55.555	58.757	*******	2.715	59.331	55.393
13.	6.977	23.052	55.763	51.239	51.193	56.294	53.842	54.815	54.283	*******	2.715	54.398	55.347
14.	7.131	30.292	54.306	53.750	53.773	54.236	53.796	54.375	54.584	*******	2.715	55.116	54.699
15.	7.871	42.176	61.647	57.773	57.704	61.944	59.473	61.099	61.053	*******	2.715	62.013	61.830
16.	8.003	29.059	61.122	58.601	59.106	60.687	59.404	59.977	59.404	*******	2.715	59.702	60.367

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITHOUT EXPLOSAFE - FILE NAME : TEST 16

DATE OF TEST = FEB 1, 1984 Q IN = 65 KW/M SQ LIQUID LEVEL = 76 PERCENT

SET PRESSURE = 35 PSIG PRV ORIFICE DIAMETER = 3/8 INCHES

	TIME MINS	PRESSURE PSIG	THRM034 C	THRM035 C	THRM036 C	THRM037 C	THRM038 C	THRM039 C	THRM040 C	THRM041 C	THRM042 C	THRM043 C
1.	0.141	-0.026	23.161	23.587	22.987	23.258	23.510	0.000	2.679	22.697	22.890	22.716
2.	0.730	0.522	26.834	26.062	25.849	27.412	25.772	49.682	2.679	22.697	22.910	22.716
3.	1.331	1.684	32.684	27.490	31.225	34.525	27.413	12.927	2.680	22.756	22.930	22.736
4.	1.928	3.141	39.305	29.262	38.484	43.687	28.877	0.000	2.679	22.852	23.007	22.852
5.	2.528	4.958	45.817	30.880	47.050	54.466	31.437	43.784	2.680	23.163	23.183	23.105
6.	3.134	7.369	52.918	34.469	56.332	66.660	34.679	32.417	2.680	23.686	23.512	23.589
7.	3.737	10.394	59.853	37.704	66.399	79.935	37.818	0.000	2.680	24.480	24.055	24.345
8.	4.346	14.106	66.492	41.290	77.053	93.559	41.881	56.163	2.680	25.639	24.846	25.426
9.	4.966	18.665	72.957	45.344	87.963	107.470	45.819	27.705	2.680	27.185	25.930	26.895
10.	5.582	24.263	78.805	49.821	98.778	121.120	49.594	5.823	2.680	29.152	27.322	28.748
11.	6.207	31.181	82.729	53.414	109.710	135.030	54.263	10.935	2.680	31.538	28.999	31.000
12.	6.852	39.779	85.543	58.523	120.560	148.050	58.316	0.000	2.680	34.495	31.021	33.786
13.	6.977	23.052	54.454	54.152	56.094	62.112	54.265	175.020	2.680	35.106	31.444	34.380
14.	7.131	30.292	59.896	58.166	83.652	101.320	58.316	0.000	2.680	35.855	31.924	35.089
15.	7.871	42.176	85.304	64.740	126.820	157.740	65.246	0.000	2.681	40.117	34.823	39.029
16.	8.003	29.059	59.804	60.105	60.988	62.752	59.936	38.361	2.681	40.899	35.378	39.793

PLOTS OF A TEST

CARRIED OUT ON THE UNB TANK 2

WITHOUT EXPLOSAFE

TEST NUMBER 17

Q in = 65 kW/m sq

LIQUID LEVEL = 58 %

SET PRESSURE = 35 psig

PRV ORIFICE DIAMETER = 3/8 in.

Date of Test FEB 16, 1984

TABLE OF CONTENTS

Thermocouple Grid Layout - - - - - - - - - - - - - -

1. For the Thermocouples Placed in a Vertical Line:

   (a) Plots of Temperature Vs Time - - - - - - - -

   (b) Plots of Height Vs. Temperature - - - - - - -

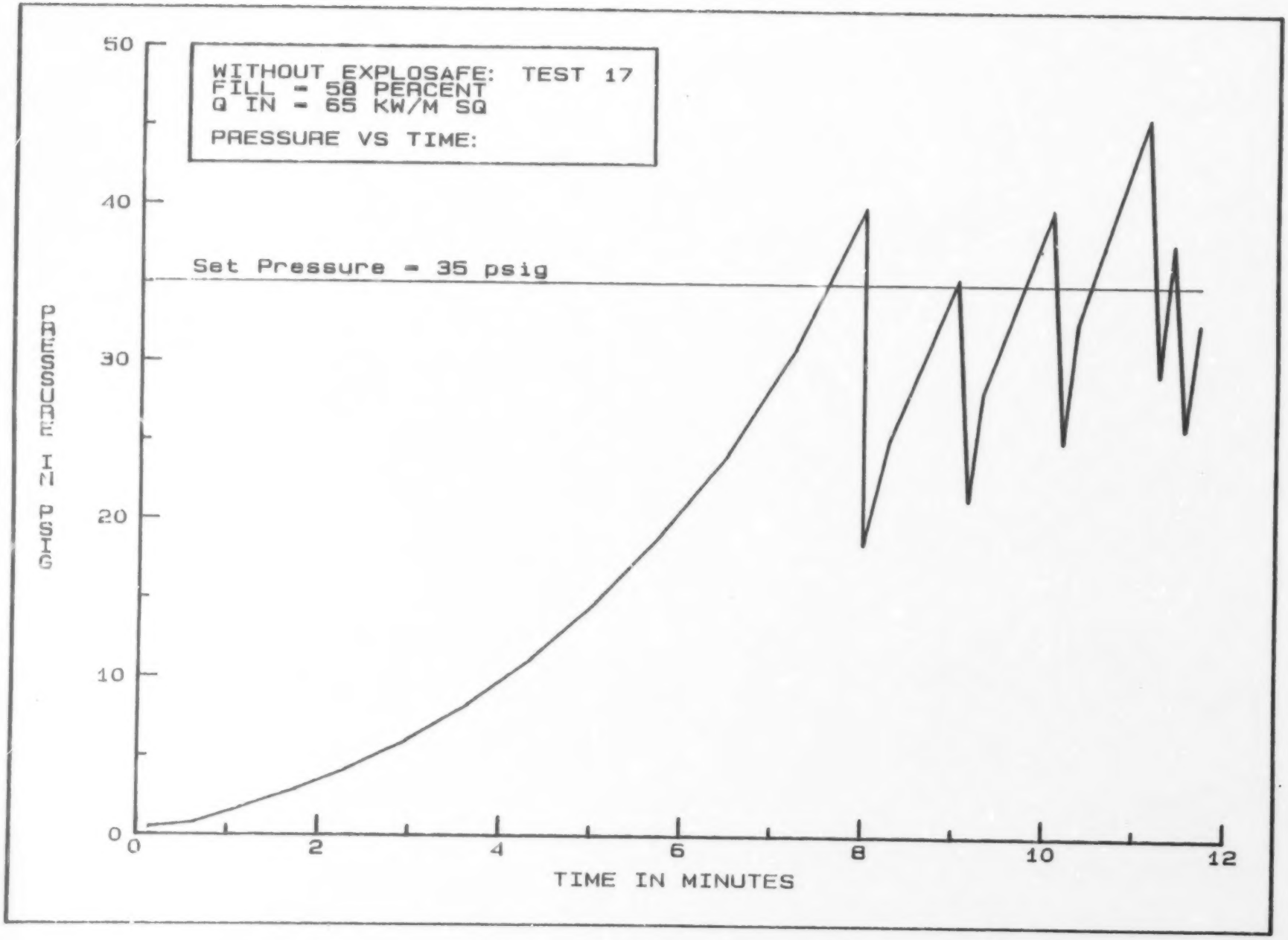
2. Thermocouples Placed in the Four Quadrants in a Vertical Plane: Temp. Vs. Time - - - - - -

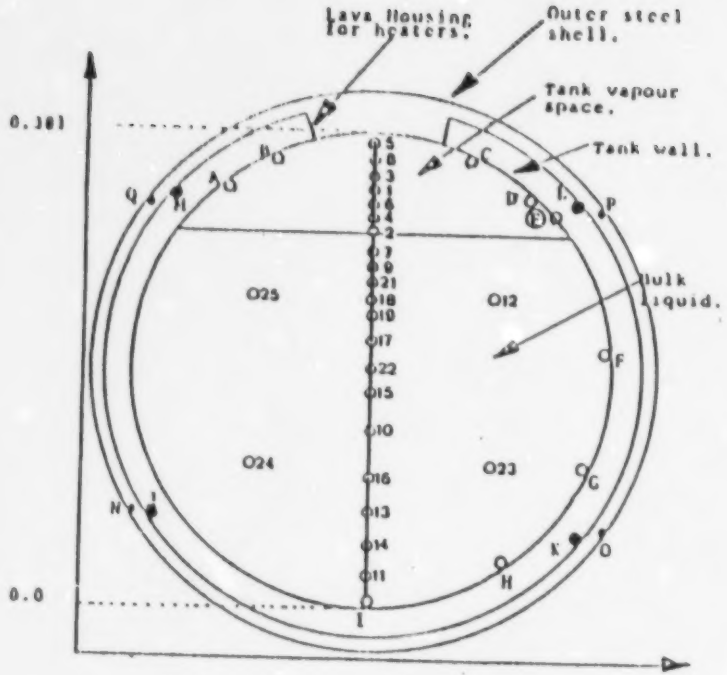
Thermocouple Grid Layout - - - - - - - - - - - - -

3. Thermocouples Placed On and Inside the Mild Steel Shell: Temp. Vs. Time - - - - - - -

4. Thermocouples Placed in the Lava Medium Temp. Vs. Time - - - - - - - - - - - - - - - -

6. Print out of Data - - - - - - - - - - - - - -


WITHOUT EXPLOSAFE: TEST 17
FILL = 58 PERCENT
Q IN = 65 KW/M SQ
PRESSURE VS TIME:
Set Pressure = 35 psig
PRESSURE IN PSIG
TIME IN MINUTES
0
10
20
30
40
50
0
2
4
6
8
10
12



SYMBOL	Thermocouple #	Angle(Deg)
A	28	310
B & C	37 & 29	340 & 22
D & E	36 & 34	55 & 56
F & G	27 & 38	92 & 116
H & I	35 & 26	144 & 180
J & K	30 & 31	133 & 220
L & M	32 & 33	50 & 300
N & O	42 & 43	140 & 230
P & Q	39 & 41	60 & 310

○ Circled thermocouple is inserted inside the vapour space wall.

Number 45 represents time in seconds.
Number 44 represents pressure in psig.
Reference upper diameter = 48.37 cms.

Thermocouple numbers.	Height (cm)	Angle with the vertical (Deg.)	Doubtful or faulty Thermocouple.
05	45.88	-	-
08	44.905	-	-
03	43.63	-	YES
01	42.715	-	-
06	41.805	-	-
04	40.745	-	-
02	39.885	-	-
07	37.765	-	-
09	36.845	-	-
21	35.705	-	-
18	34.84	-	-
19	33.86	-	YES
17	31.72	-	-
22	29.635	-	-
15	27.665	-	-
10	25.585	-	-
16	24.585	-	-
13	21.02	-	-
14	16.94	-	-
11	12.81	-	-
26	10.255	180	-
29 & 36	-	22 & 55	-
28 & 37	-	310 & 340	-
27 & 38	-	92 & 116	-
35	-	144	-
30 & 31	-	133 & 220	-
32 & 33	-	50 & 300	-
39 & 41	-	60 & 310	-
42 & 43	-	140 & 230	-
34	-	56	YES
23 & 25	-	-	YES
12	32.20	-	-
24	24.85	-	-
20 & 40	Reference temperature	-	-

Fig. III.B A grid layout of thermocouples along with their locations for an unprotected vessel(UNB) with the PRV orifice of 3/8 in. (Valid for 76, 58 and 23 percent liquid full cases)

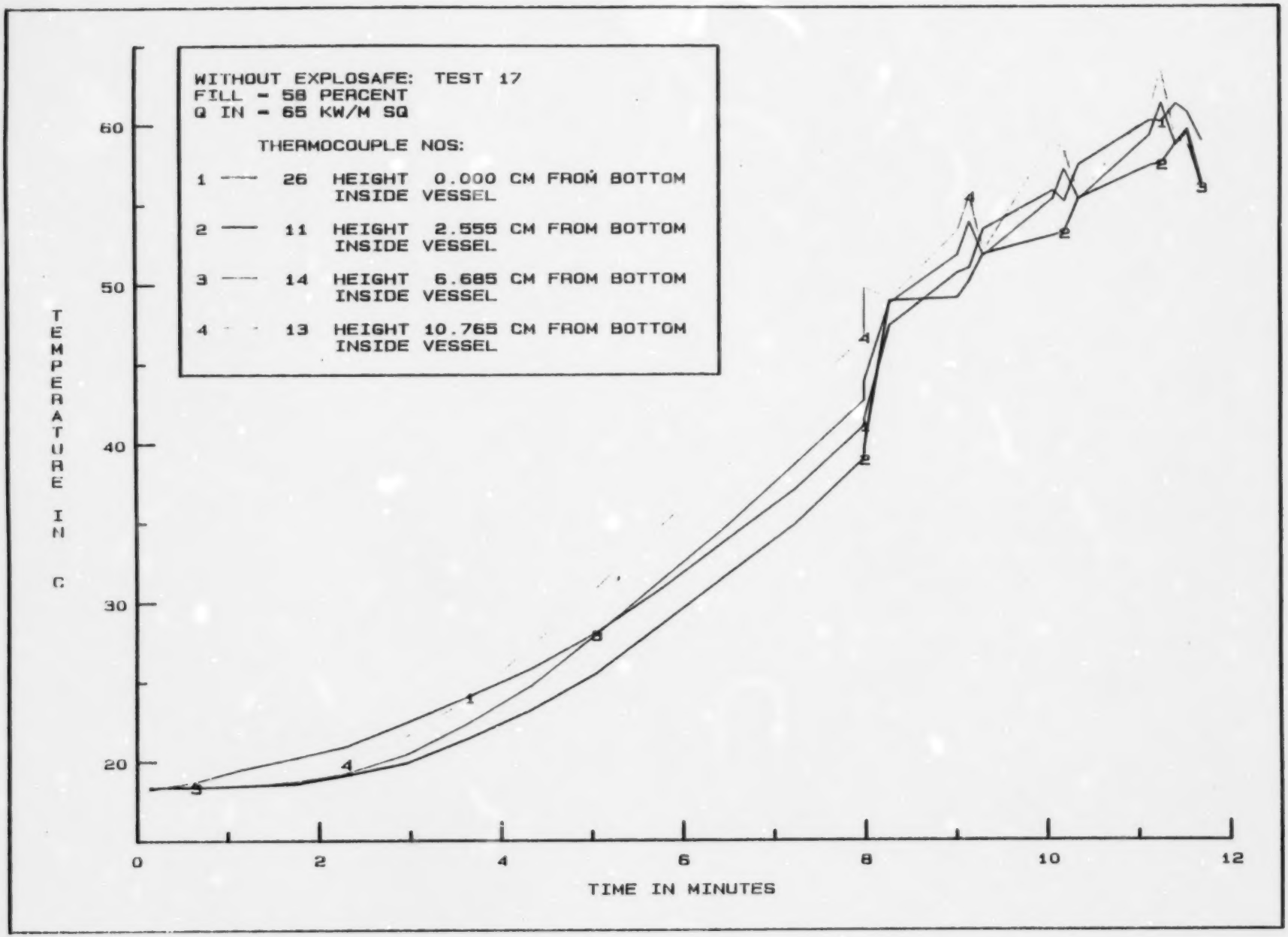
FOLLOWING THERMOCOUPLES ARE PLACED

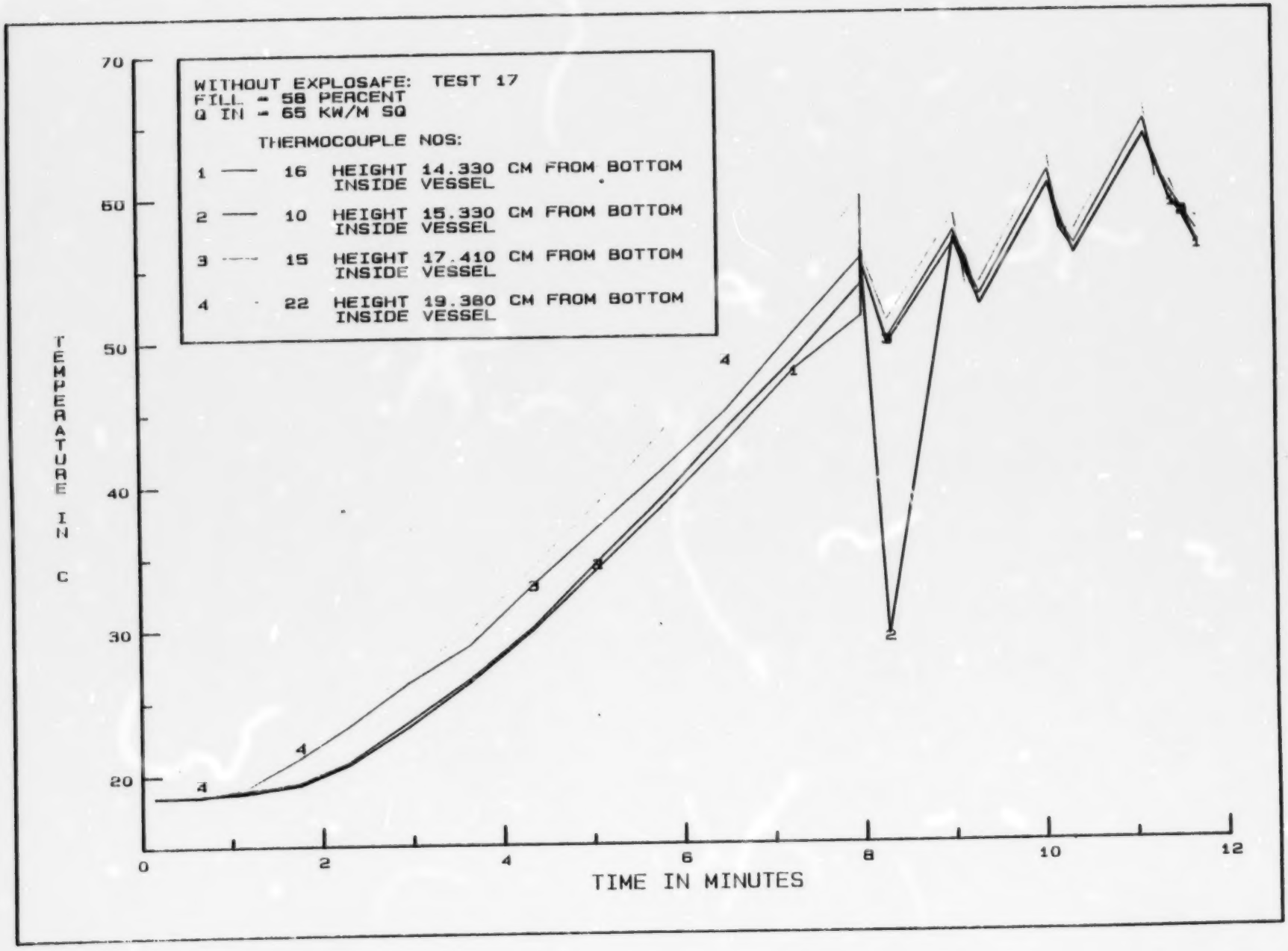
AT THE CENTRE OF THE VESSEL (DIA. 38.1 CM)

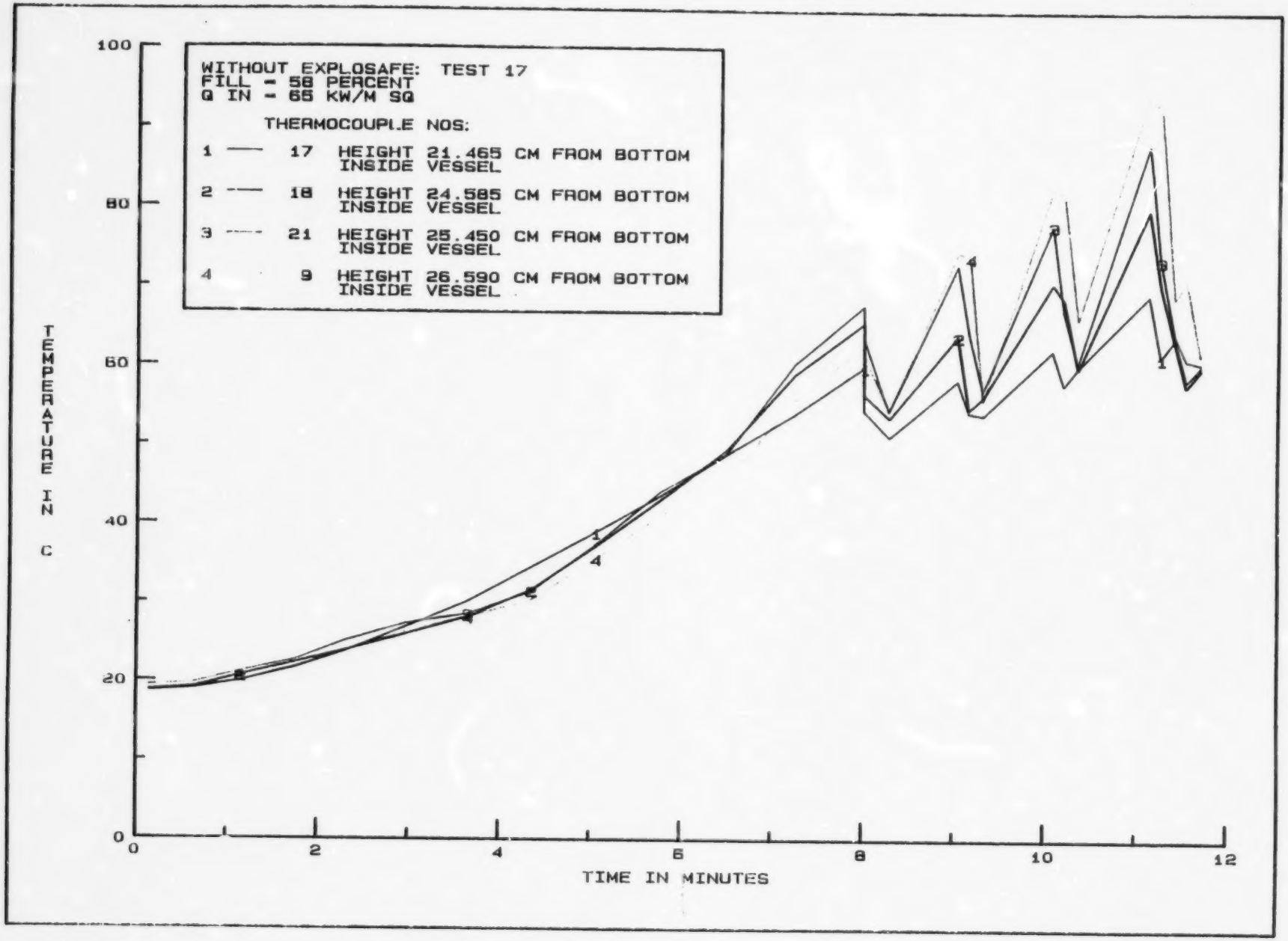
IN A VERTICLE AXIS

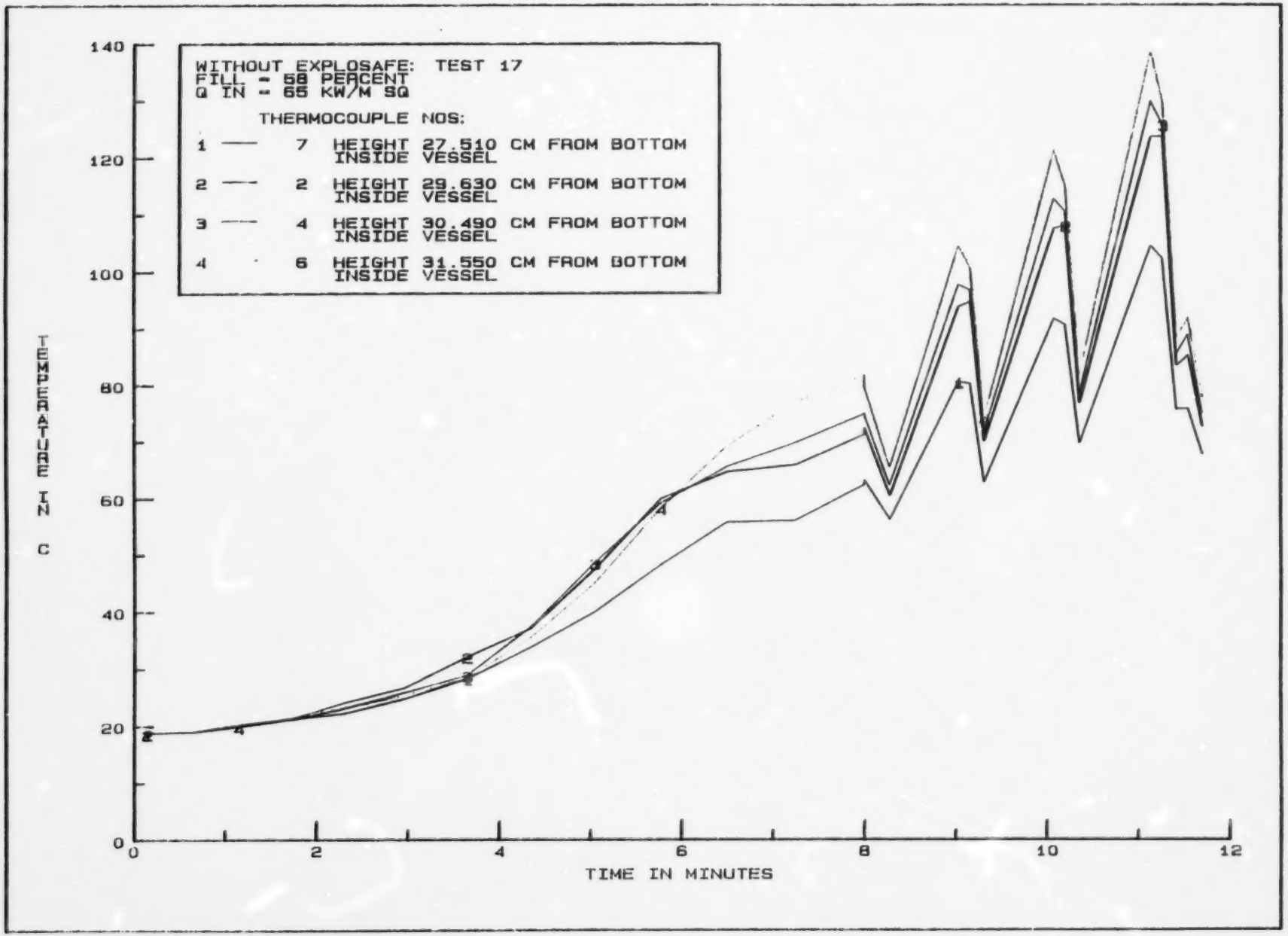
THERMOCOUPLE NUM.	HEIGHT FROM BOTTOM IN cm
28 OR I	0
11	2.555
14	6.685
13	10.765
16	14.33
10	15.33
15	17.41
22	19.38
17	21.465
18	24.585
21	25.45
9	26.59
7	27.51
2	29.63
4	30.49
6	31.55
1	32.46
8	34.65
5	35.625

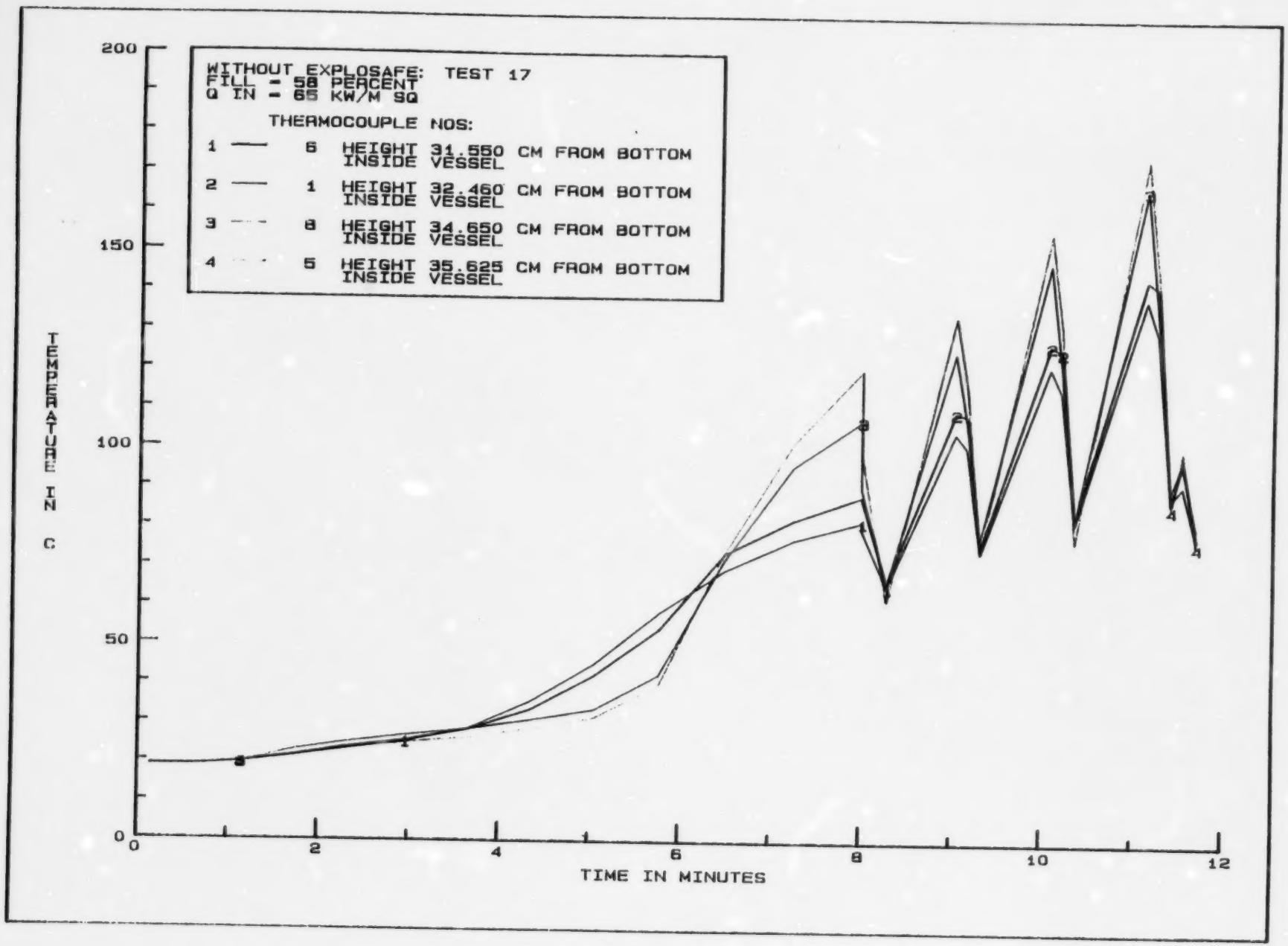
PLOTS ARE GIVEN PER PAGE


WITHOUT EXPLOSAFE: TEST 17
FILL - 58 PERCENT
Q IN - 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 26 HEIGHT 0.000 CM FROM BOTTOM INSIDE VESSEL
2 —— 11 HEIGHT 2.555 CM FROM BOTTOM INSIDE VESSEL
3 —— 14 HEIGHT 6.685 CM FROM BOTTOM INSIDE VESSEL
4 - - 13 HEIGHT 10.765 CM FROM BOTTOM INSIDE VESSEL
TEMPERATURE IN C
60
50
40
30
20
0
2
4
6
8
10
12
TIME IN MINUTES


WITHOUT EXPLOSAFE: TEST 17
FILL = 58 PERCENT
Q IN = 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 16 HEIGHT 14.330 CM FROM BOTTOM INSIDE VESSEL
2 —— 10 HEIGHT 15.330 CM FROM BOTTOM INSIDE VESSEL
3 —— 15 HEIGHT 17.410 CM FROM BOTTOM INSIDE VESSEL
4 —— 22 HEIGHT 19.380 CM FROM BOTTOM INSIDE VESSEL
TEMPERATURE IN C
70
60
50
40
30
20
0
2
4
6
8
10
12
TIME IN MINUTES


WITHOUT EXPLOSAFE: TEST 17
FILL - 58 PERCENT
Q IN - 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 17 HEIGHT 21.465 CM FROM BOTTOM INSIDE VESSEL
2 —— 18 HEIGHT 24.585 CM FROM BOTTOM INSIDE VESSEL
3 —— 21 HEIGHT 25.450 CM FROM BOTTOM INSIDE VESSEL
4 9 HEIGHT 26.590 CM FROM BOTTOM INSIDE VESSEL
TEMPERATURE IN C
100
80
60
40
20
0
0
2
4
6
8
10
12
TIME IN MINUTES


WITHOUT EXPLOSAFE: TEST 17
FILL = 58 PERCENT
Q IN = 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 7 HEIGHT 27.510 CM FROM BOTTOM INSIDE VESSEL
2 —— 2 HEIGHT 29.630 CM FROM BOTTOM INSIDE VESSEL
3 —— 4 HEIGHT 30.490 CM FROM BOTTOM INSIDE VESSEL
4 6 HEIGHT 31.550 CM FROM BOTTOM INSIDE VESSEL
TEMPERATURE IN C
TIME IN MINUTES
0
20
40
60
80
100
120
140
0
2
4
6
8
10
12


WITHOUT EXPLOSAFE: TEST 17
FILL - 58 PERCENT
Q IN - 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 6 HEIGHT 31.550 CM FROM BOTTOM INSIDE VESSEL
2 —— 1 HEIGHT 32.460 CM FROM BOTTOM INSIDE VESSEL
3 — — 8 HEIGHT 34.650 CM FROM BOTTOM INSIDE VESSEL
4 — · 5 HEIGHT 35.625 CM FROM BOTTOM INSIDE VESSEL
TEMPERATURE IN C
200
150
100
50
0
0
2
4
6
8
10
12
TIME IN MINUTES

FOLLOWING ARE HEIGHT VS TEMPERATURE

PLOTS FOR THE

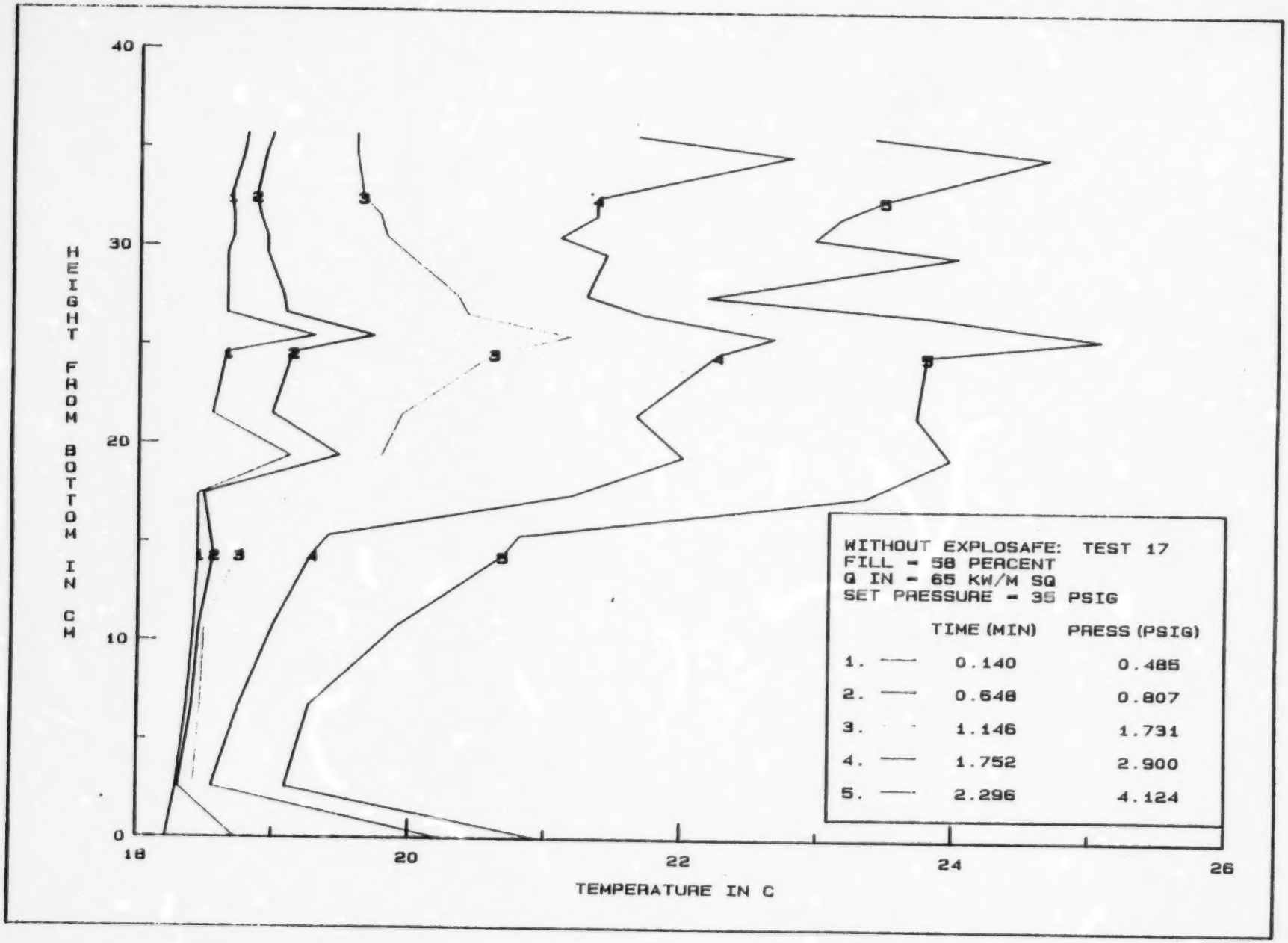
THERMOCOUPLES PLACED AT THE CENTRE

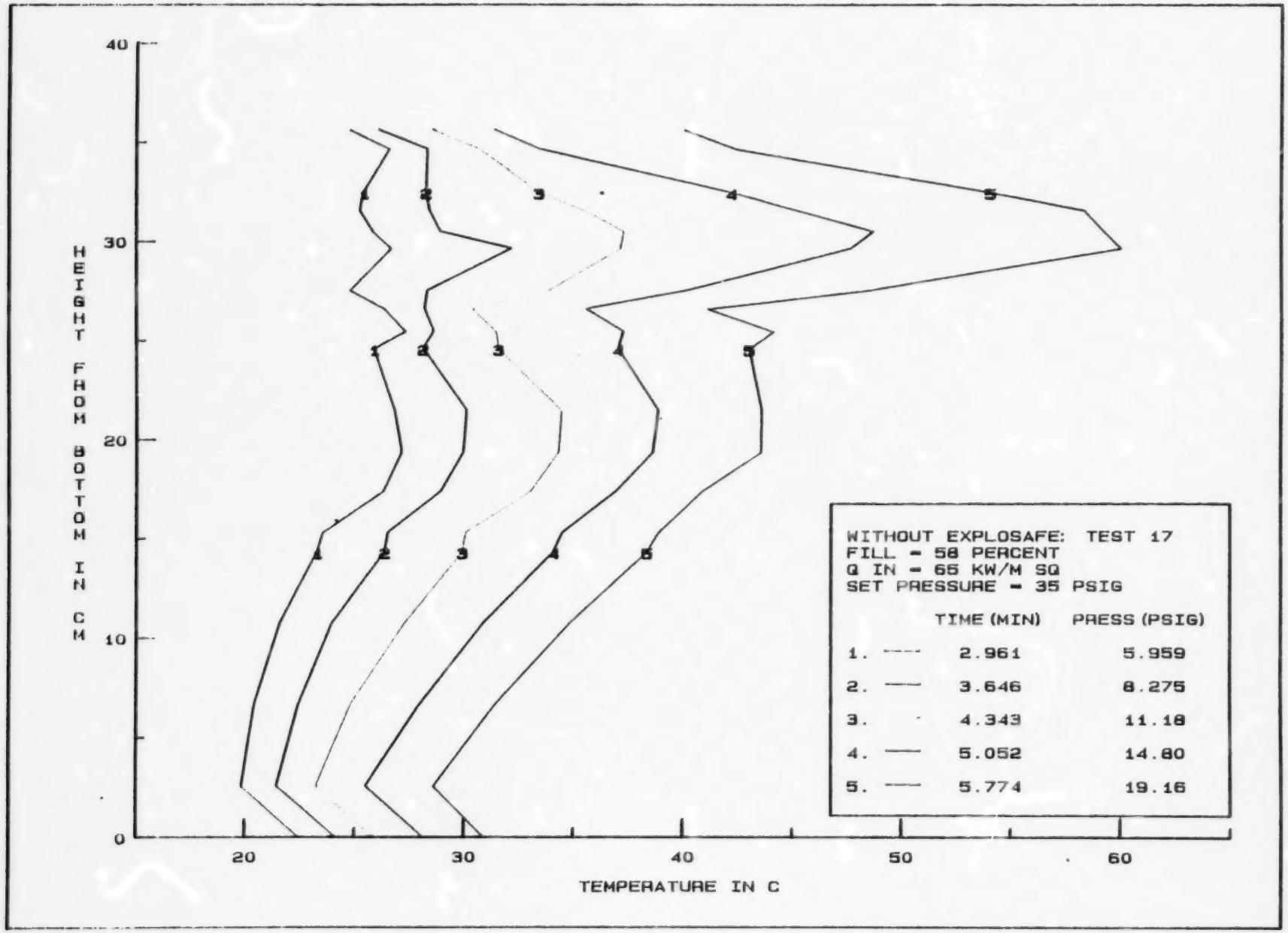
OF THE VESSEL

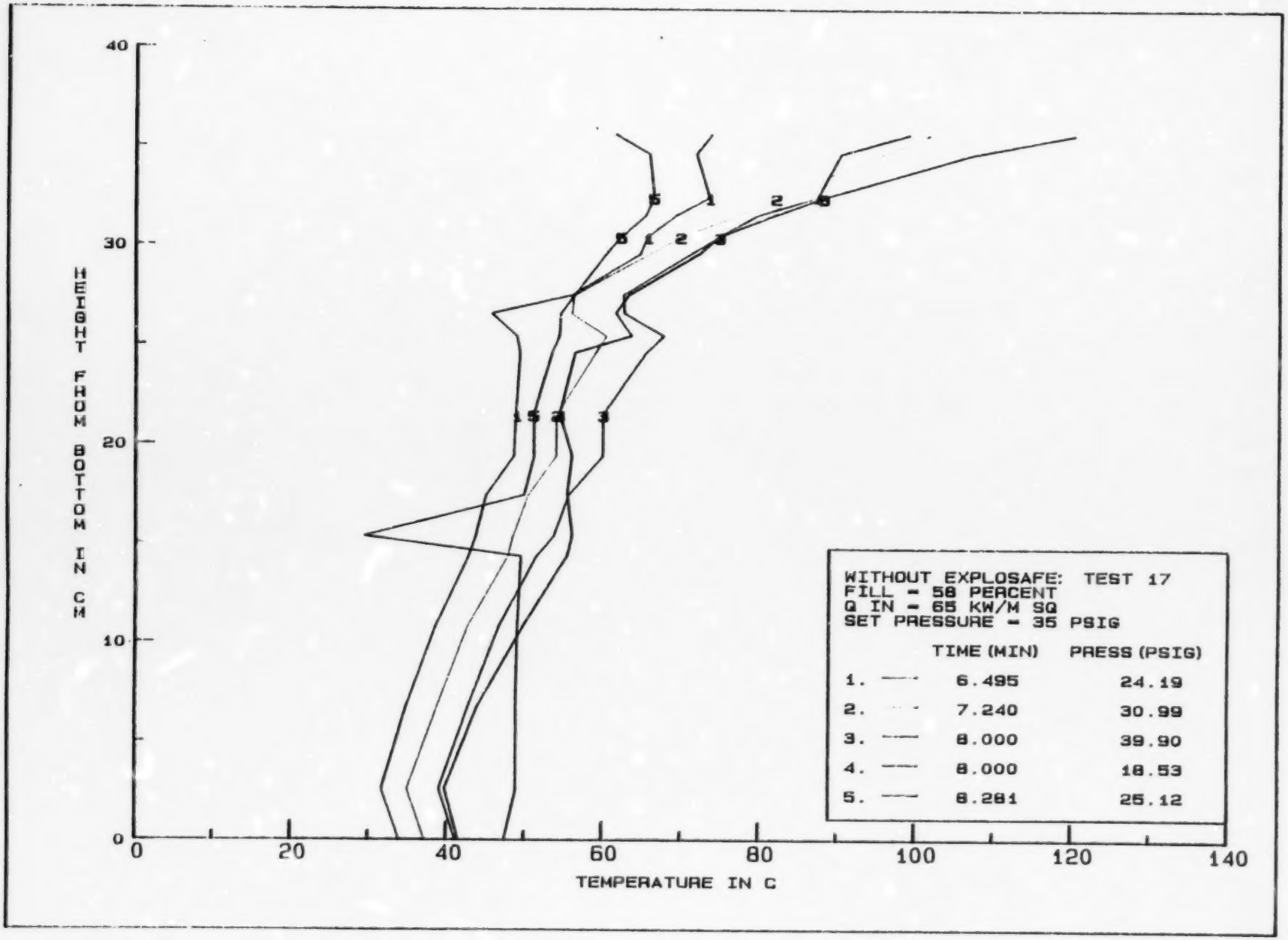
IN A VERTICAL AXIS.

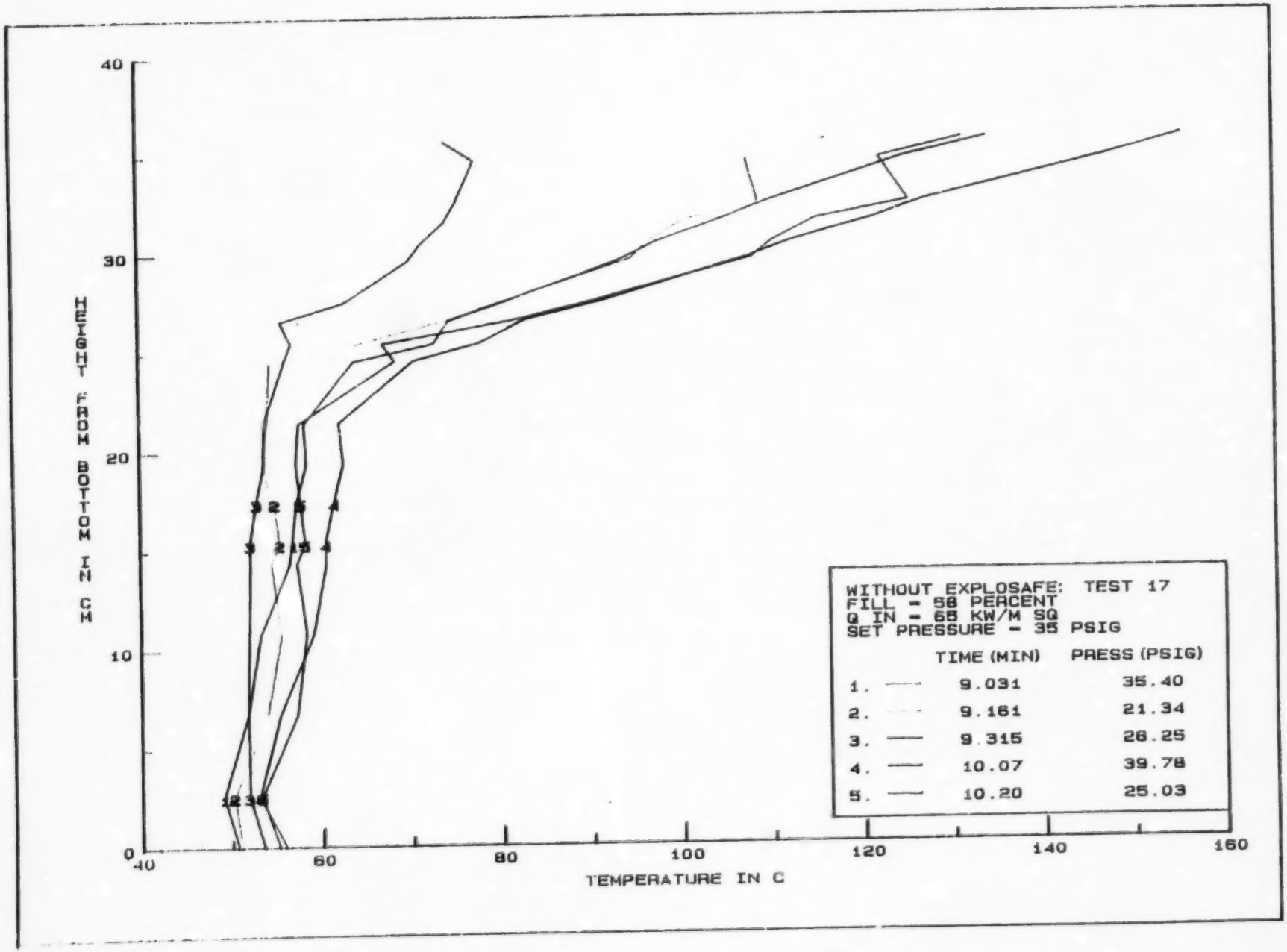
* EACH PLOT REPRESENTS ONE SCAN OF ALL THE THERMOCOUPLES

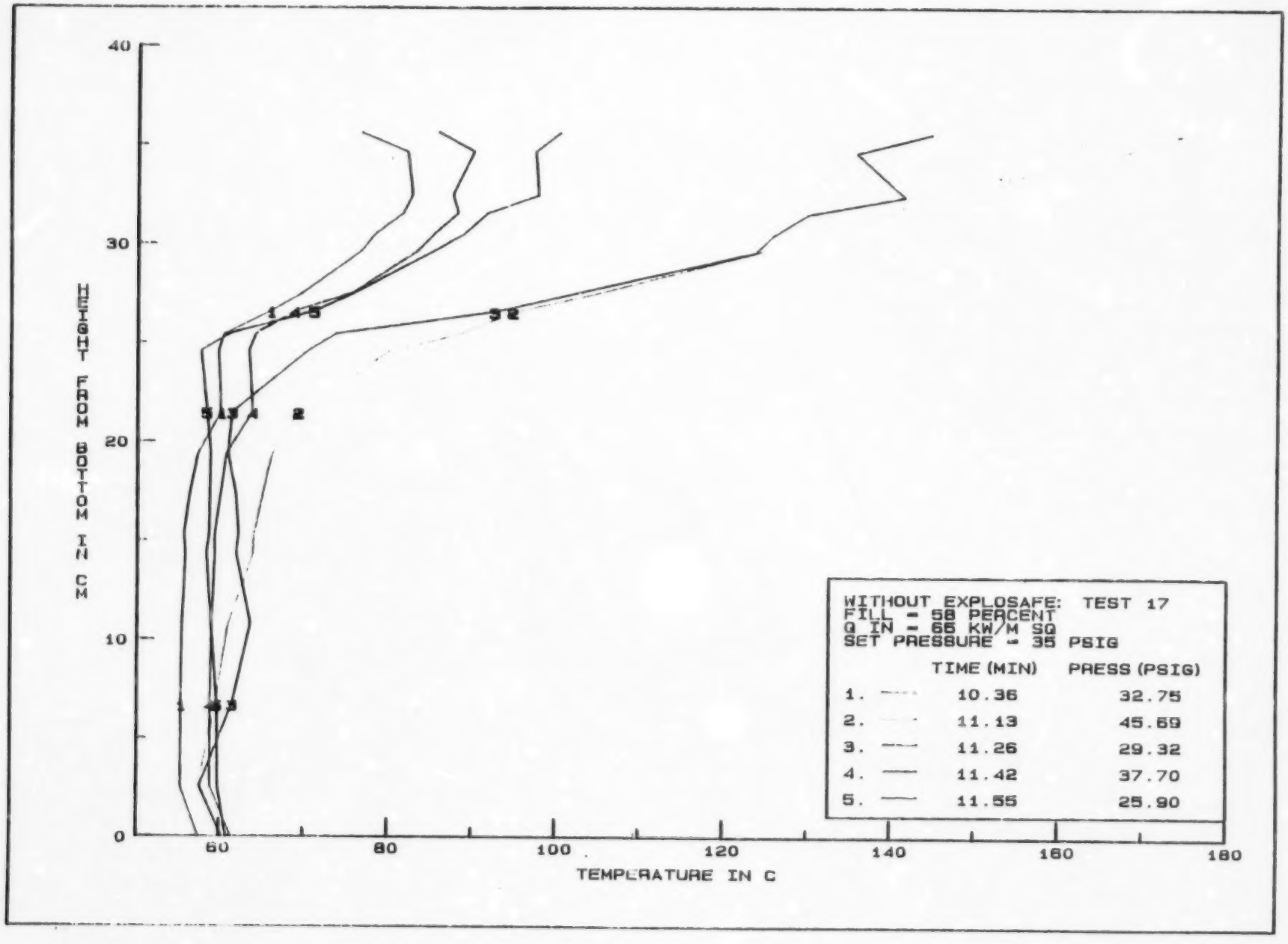
* PLOTS ARE GIVEN AS FIVE (5) SCANS PER PAGE

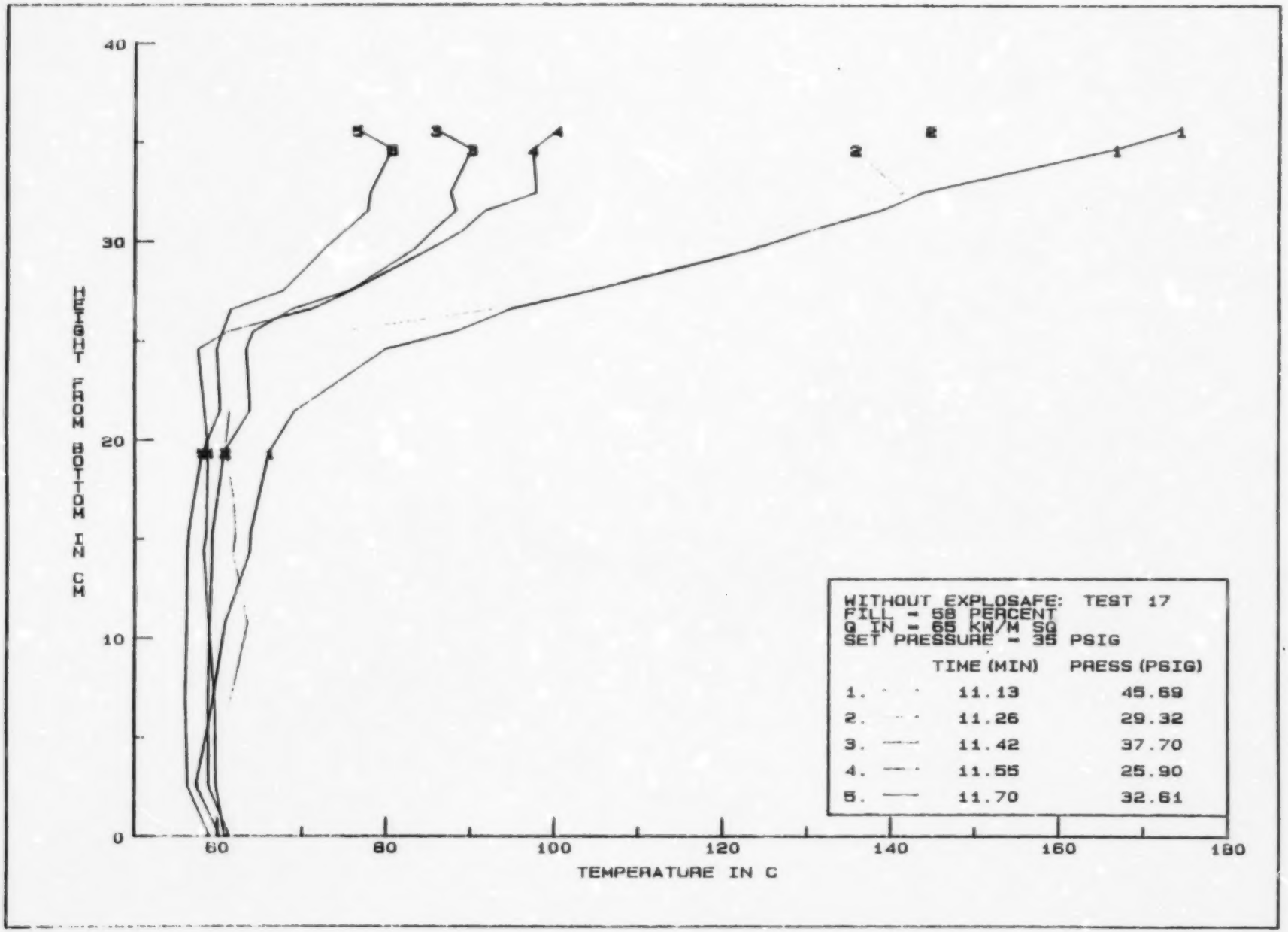

HEIGHT FROM BOTTOM IN CM
40
30
20
10
0
18
20
22
24
26
TEMPERATURE IN C
WITHOUT EXPLOSAFE: TEST 17
FILL - 58 PERCENT
Q IN - 65 KW/M SQ
SET PRESSURE - 35 PSIG
TIME (MIN) PRESS (PSIG)
1. 0.140 0.485
2. 0.648 0.807
3. 1.146 1.731
4. 1.752 2.900
5. 2.296 4.124


HEIGHT FROM BOTTOM IN CM
40
30
20
10
0
20
30
40
50
60
TEMPERATURE IN C
WITHOUT EXPLOSAFE: TEST 17
FILL - 58 PERCENT
Q IN - 65 KW/M SQ
SET PRESSURE - 35 PSIG
TIME (MIN) PRESS (PSIG)
1. 2.961 5.959
2. 3.646 8.275
3. 4.343 11.18
4. 5.052 14.80
5. 5.774 19.16


HEIGHT FROM BOTTOM IN CM
TEMPERATURE IN C
0
10
20
30
40
0
20
40
60
80
100
120
140
WITHOUT EXPLOSAFE: TEST 17
FILL - 58 PERCENT
Q IN - 65 KW/M SQ
SET PRESSURE - 35 PSIG
TIME (MIN) PRESS (PSIG)
1. 6.495 24.19
2. 7.240 30.99
3. 8.000 39.90
4. 8.000 18.53
5. 8.281 25.12

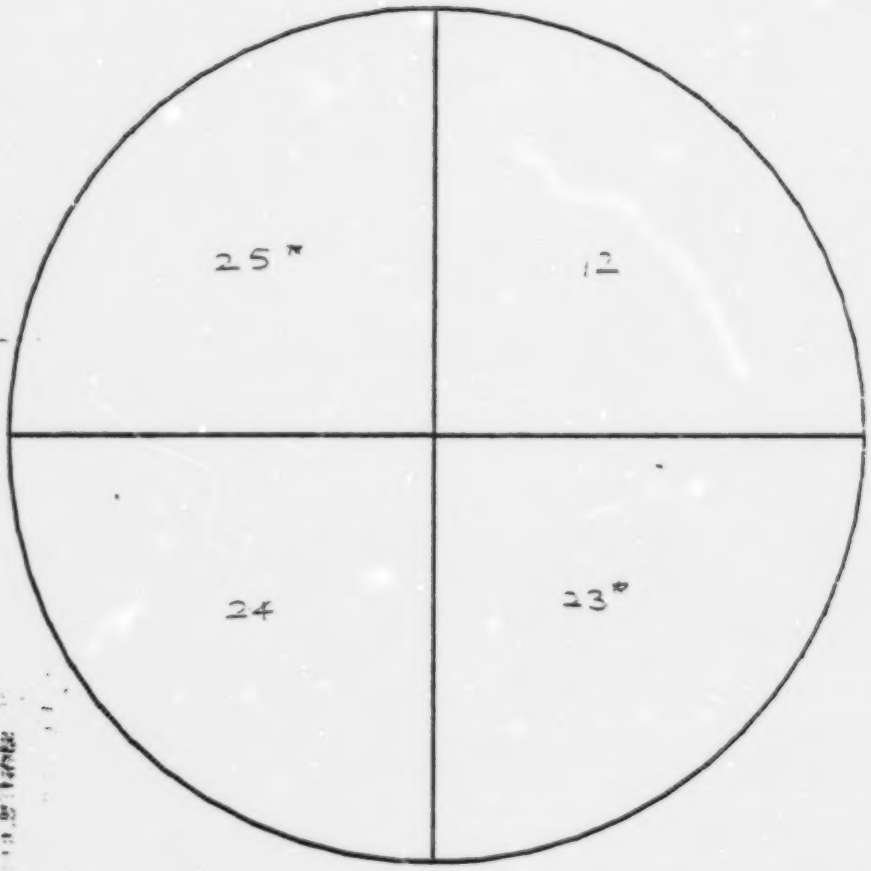

HEIGHT FROM BOTTOM IN CM
40
30
20
10
0
40
60
80
100
120
140
160
TEMPERATURE IN C
WITHOUT EXPLOSAFE: TEST 17
FILL = 58 PERCENT
Q IN = 65 KW/M SQ
SET PRESSURE = 35 PSIG
TIME (MIN) PRESS (PSIG)
1. 9.031 35.40
2. 9.161 21.34
3. 9.315 28.25
4. 10.07 39.78
5. 10.20 25.03


HEIGHT FROM BOTTOM IN CM
TEMPERATURE IN C
0
10
20
30
40
60
80
100
120
140
160
180
WITHOUT EXPLOSAFE: TEST 17
FILL = 58 PERCENT
Q IN = 65 KW/M SQ
SET PRESSURE = 35 PSIG
TIME (MIN) PRESS (PSIG)
1. 10.36 32.75
2. 11.13 45.69
3. 11.26 29.32
4. 11.42 37.70
5. 11.55 25.90


HEIGHT FROM BOTTOM IN CM
0
10
20
30
40
60
80
100
120
140
160
180
TEMPERATURE IN C
WITHOUT EXPLOSAFE: TEST 17
FILL = 58 PERCENT
Q IN = 65 KW/M SQ
SET PRESSURE = 35 PSIG
TIME (MIN) PRESS (PSIG)
1. 11.13 45.69
2. 11.26 29.32
3. 11.42 37.70
4. 11.55 25.90
5. 11.70 32.61

FOLLOWING FOUR THERMOCOUPLES ARE PLACED

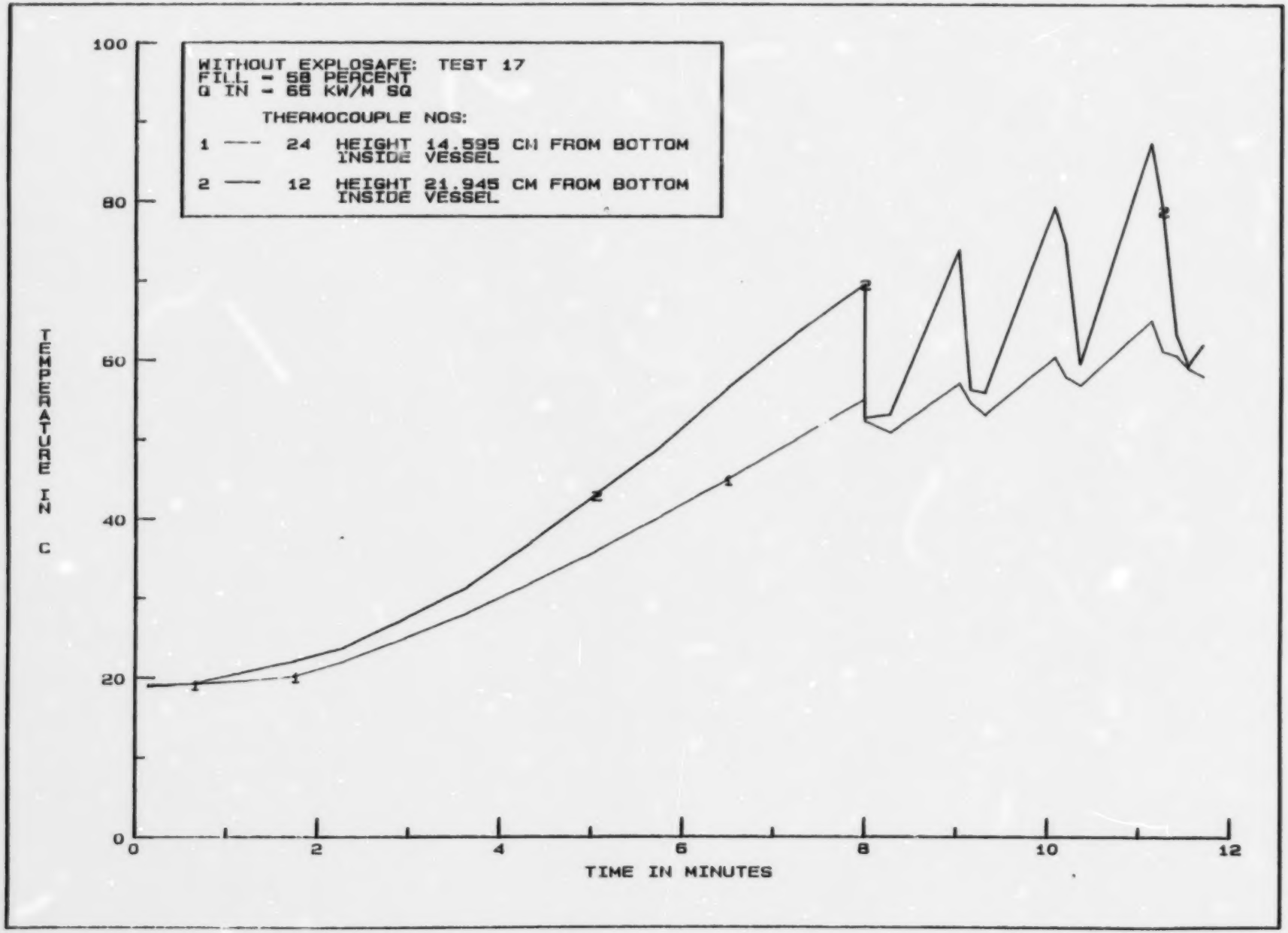
AT THE FOUR QUADRANTS ON A VERTICAL PLANE

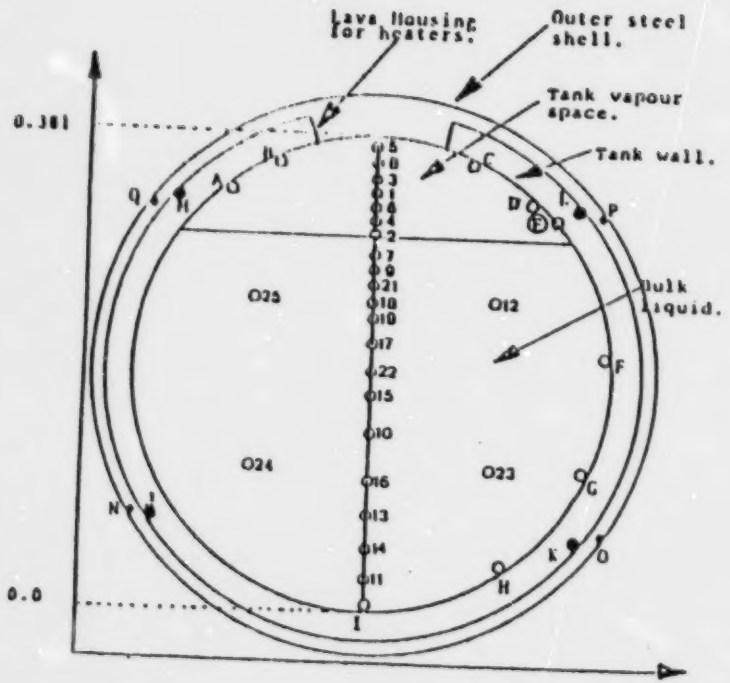


THERMOCOUPLE NUM.	HEIGHT FROM BOTTOM IN cm
24 AND 23	14.595
25 AND 12	21.945

PLOTS ARE GIVEN TWO PER PAGE

* Thermocouple Nos. 23 and 25 were FAULTY during experiment ****


WITHOUT EXPLOSAFE: TEST 17
FILL - 58 PERCENT
Q IN - 65 KW/M SQ
THERMOCOUPLE NOS:
1 --- 24 HEIGHT 14.595 CM FROM BOTTOM INSIDE VESSEL
2 --- 12 HEIGHT 21.945 CM FROM BOTTOM INSIDE VESSEL
TEMPERATURE IN C
100
80
60
40
20
0
0
2
4
6
8
10
12
TIME IN MINUTES



SYMBOL	Thermocouple #	Angle(Deg)
A	28	310
B & C	37 & 29	340 & 22
D & E	36 & 34	55 & 56
F & G	27 & 38	92 & 116
H & I	35 & 26	144 & 180
J & K	30 & 31	133 & 220
L & M	32 & 33	50 & 300
N & O	42 & 43	140 & 230
P & Q	39 & 41	60 & 310

◯ Circled thermocouple is inserted inside the vapour space wall.

Number 45 represents time in seconds.
Number 44 represents pressure in psig.
Reference upper diameter = 48.37 cms.

Thermocouple numbers.	Height (cm)	Angle with the vertical (Deg.)	Doubtful or faulty Thermocouple.
05	45.88	-	-
08	44.905	-	-
03	43.63	-	YES
01	42.715	-	-
06	41.805	-	-
04	40.745	-	-
02	39.885	-	-
07	37.765	-	-
09	36.845	-	-
21	35.705	-	-
18	34.84	-	-
19	33.86	-	YES
17	31.72	-	-
22	29.635	-	-
15	27.665	-	-
10	25.565	-	-
16	24.585	-	-
13	21.02	-	-
14	16.94	-	-
11	12.81	-	-
26	10.255	180	-
29 & 36	-	22 & 55	-
28 & 37	-	310 & 340	-
27 & 38	-	92 & 116	-
35	-	144	-
30 & 31	-	133 & 220	-
32 & 33	-	50 & 300	-
39 & 41	-	60 & 310	-
42 & 43	-	140 & 230	-
34	-	56	YES
23 & 25	-	-	YES
12	32.20	-	-
24	24.85	-	-
20 & 40	Reference temperature	-	-

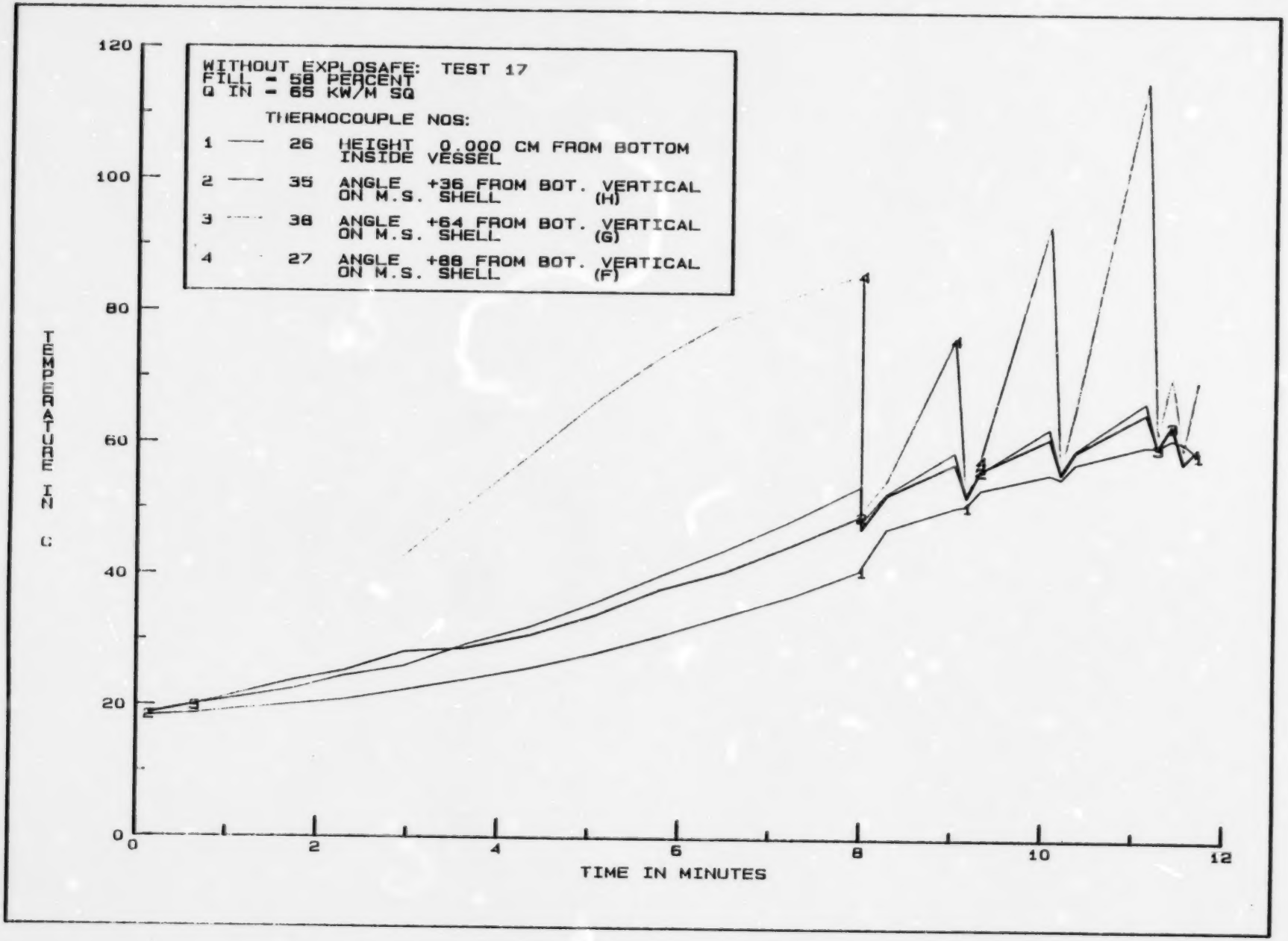
Fig. III.B A grid layout of thermocouples along with their locations for an unprotected vessel(UNB) with the PRV orifice of 3/8 in. (Valid for 76, 58 and 23 percent liquid full cases)

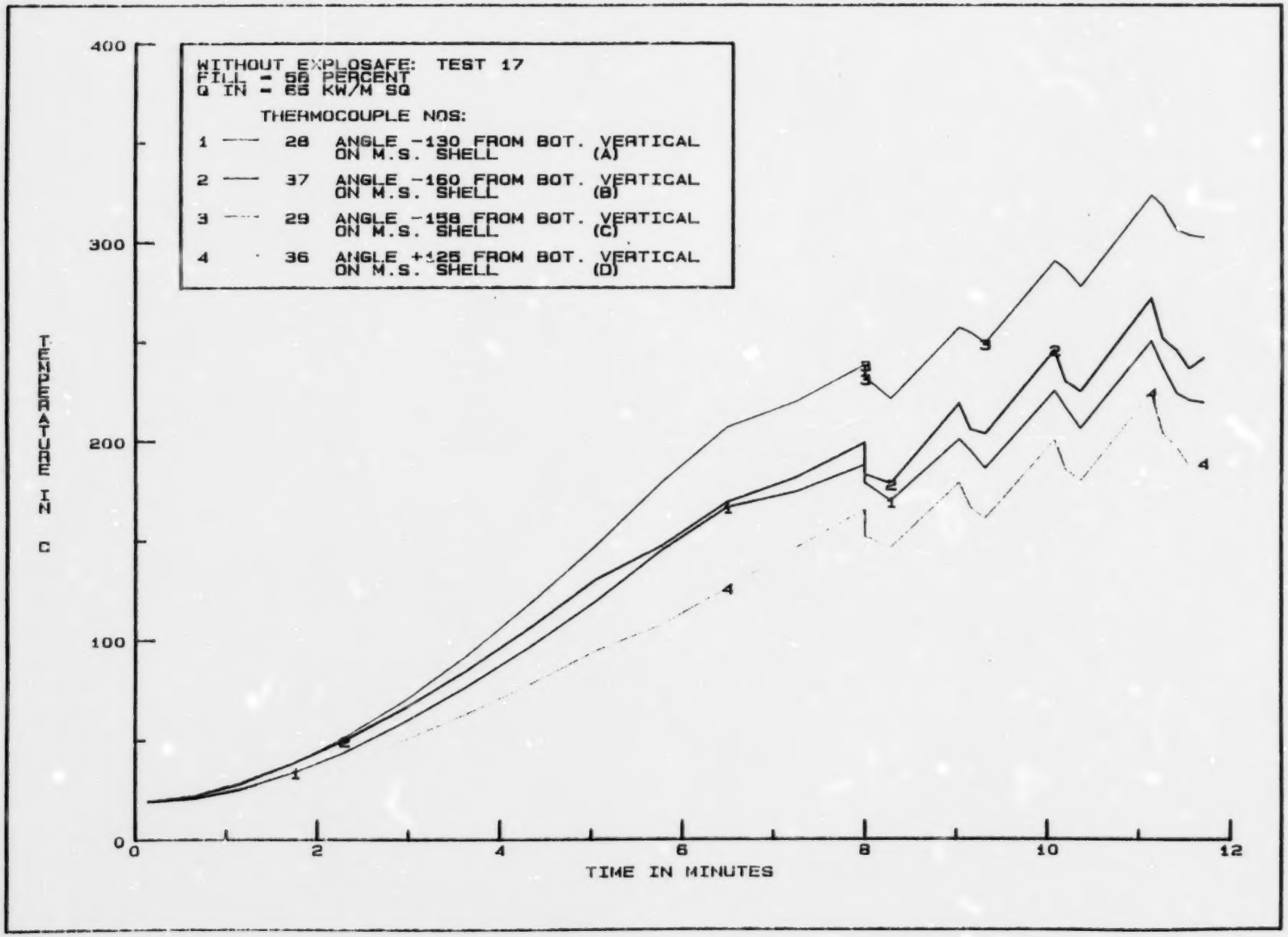
FOLLOWING THERMOCOUPLES ARE PLACED

ON THE MILD STEEL SHELL OR

INSIDE THE MILD STEEL SHELL

THERMOCOUPLE NUM.	ANGLE FROM BOTTOM VERTICAL
ON THE MILD STEEL SHELL:	
26 OR I	00
27 OR F	+88
28 OR A	−130
29 OR C	−158
35 OR H	+38
36 OR D	+125
37 OR B	−180
38 OR G	+64
INSIDE THE MILD STEEL SHELL:	
34 OR E	+124

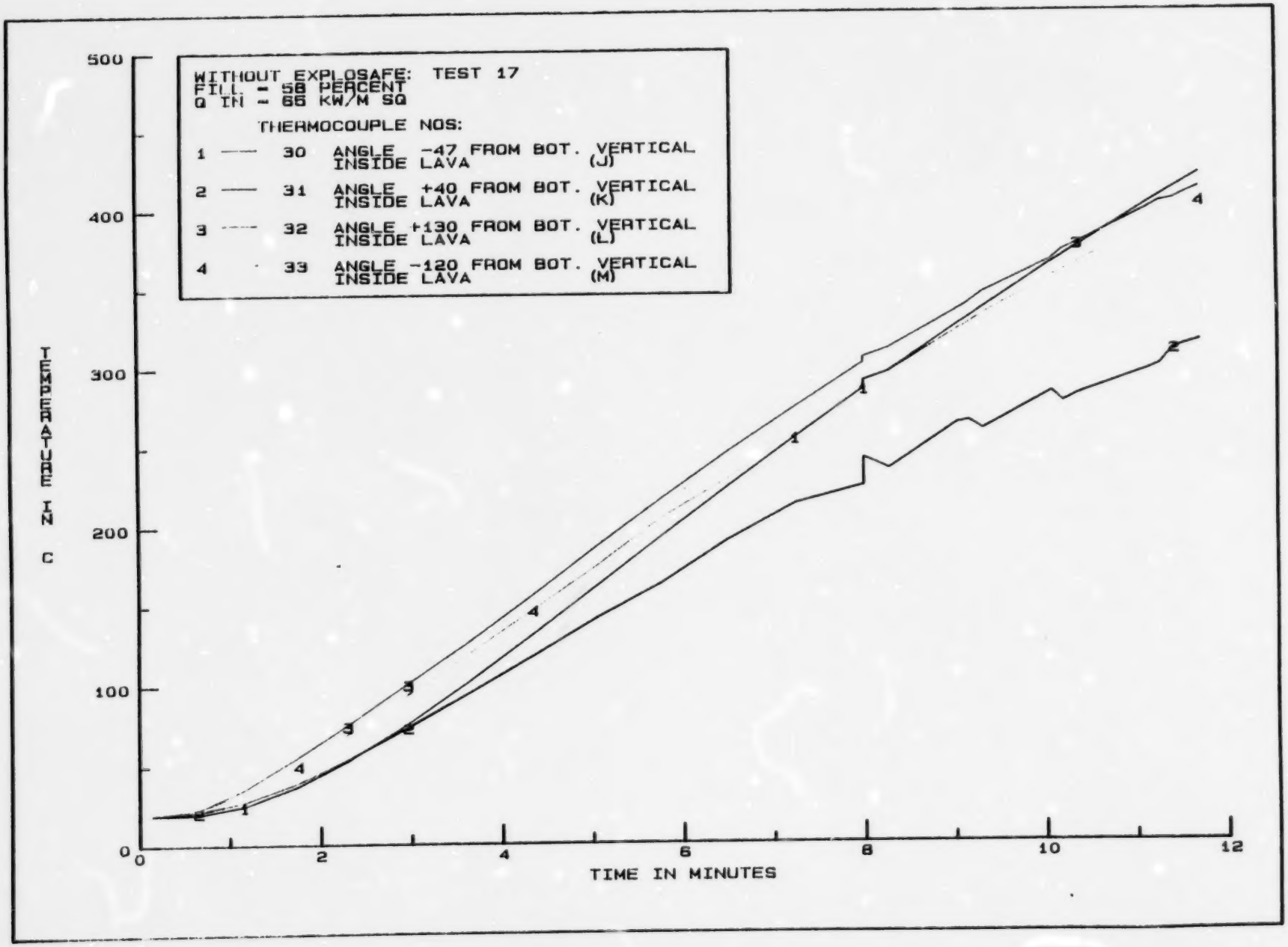

WITHOUT EXPLOSAFE: TEST 17
FILL = 58 PERCENT
Q IN = 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 26 HEIGHT 0.000 CM FROM BOTTOM INSIDE VESSEL
2 —— 35 ANGLE +36 FROM BOT. VERTICAL ON M.S. SHELL (H)
3 ---- 38 ANGLE +64 FROM BOT. VERTICAL ON M.S. SHELL (G)
4 ·-·-· 27 ANGLE +88 FROM BOT. VERTICAL ON M.S. SHELL (F)
TEMPERATURE IN C
120
100
80
60
40
20
0
0
2
4
6
8
10
12
TIME IN MINUTES


WITHOUT EXPLOSAFE: TEST 17
FILL = 56 PERCENT
Q IN = 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 28 ANGLE -130 FROM BOT. VERTICAL ON M.S. SHELL (A)
2 —— 37 ANGLE -160 FROM BOT. VERTICAL ON M.S. SHELL (B)
3 —— 29 ANGLE -158 FROM BOT. VERTICAL ON M.S. SHELL (C)
4 —— 36 ANGLE +125 FROM BOT. VERTICAL ON M.S. SHELL (D)
TEMPERATURE IN C
400
300
200
100
0
0
2
4
6
8
10
12
TIME IN MINUTES

FOLLOWING THERMOCOUPLES ARE PLACED IN THE LAVA MEDIUM

THERMOCOUPLE NUM.	ANGLE FROM BOTTOM VERTICAL
30 OR J	-47
31 OR K	+40
32 OR L	+130
33 OR M	-120

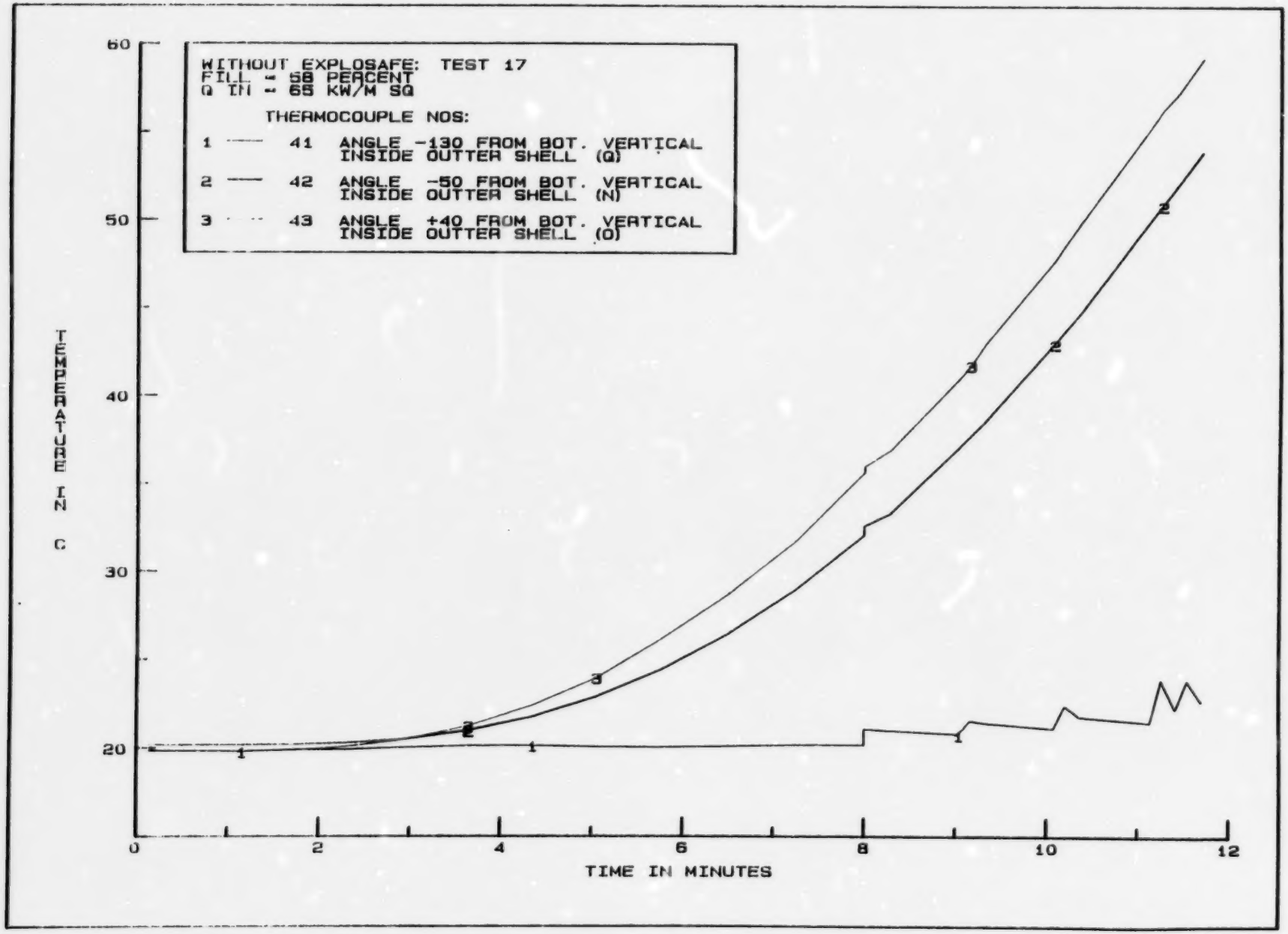
ALL FOUR PLOTS ARE GIVEN ON ONE PAGE


WITHOUT EXPLOSAFE: TEST 17
FILL - 58 PERCENT
Q IN - 66 KW/M SQ
THERMOCOUPLE NOS:
1 —— 30 ANGLE -47 FROM BOT. VERTICAL INSIDE LAVA (J)
2 —— 31 ANGLE +40 FROM BOT. VERTICAL INSIDE LAVA (K)
3 —— 32 ANGLE +130 FROM BOT. VERTICAL INSIDE LAVA (L)
4 —— 33 ANGLE -120 FROM BOT. VERTICAL INSIDE LAVA (M)
TEMPERATURE IN C
500
400
300
200
100
0
0
2
4
6
8
10
12
TIME IN MINUTES

FOLLOWING THERMOCOUPLES ARE PLACED INSIDE THE OUTTER SHELL

THERMOCOUPLE NUM.	ANGLE FROM BOTTOM VERTICAL
39 OR P	+120
41 OR Q	-130
42 OR N	-50
43 OR O	+40

ALL FOUR PLOTS ARE GIVEN ON ONE PAGE


WITHOUT EXPLOSAFE: TEST 17
FILL = 58 PERCENT
Q IN = 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 41 ANGLE -130 FROM BOT. VERTICAL INSIDE OUTTER SHELL (Q)
2 —— 42 ANGLE -50 FROM BOT. VERTICAL INSIDE OUTTER SHELL (N)
3 - - - 43 ANGLE +40 FROM BOT. VERTICAL INSIDE OUTTER SHELL (O)
TEMPERATURE IN C
60
50
40
30
20
0
2
4
6
8
10
12
TIME IN MINUTES

TEST 17

WITHOUT EXPLOSAFE

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITHOUT EXPLOSAFE - FILE NAME : TEST 17

DATE OF TEST = FEB 16,1984 Q IN = 65 KW/M SQ LIQUID LEVEL = 50 PERCENT

SET PRESSURE = 35 PSIG PRV ORIFICE DIAMETER = 3/8 INCHES

	TIME MINS	PRESSURE PSIG	THRM#1 C	THRM#2 C	THRM#3 C	THRM#4 C	THRM#5 C	THRM#6 C	THRM#7 C	THRM#8 C	THRM#9 C	THRM#10 C	THRM#11 C
1.	0.140	0.486	18.669	18.645	737.940	18.694	18.794	18.694	18.645	18.769	18.645	18.445	18.296
2.	0.649	0.808	18.855	18.937	745.390	18.938	18.979	18.880	19.054	18.930	19.079	18.531	18.307
3.	1.147	1.732	19.636	19.959	766.800	19.810	19.587	19.761	20.332	19.587	20.406	18.865	18.417
4.	1.752	2.900	21.362	21.436	875.320	21.089	21.659	21.362	21.287	22.796	21.708	19.401	18.554
5.	2.296	4.125	23.474	24.016	964.770	22.956	23.400	23.153	22.165	24.681	23.794	20.803	19.088
6.	2.961	5.960	25.382	26.658	*******	25.807	24.768	25.210	24.768	26.585	26.340	23.586	19.848
7.	3.647	8.275	28.213	32.130	*******	28.848	26.059	28.360	28.287	28.287	28.140	26.525	21.424
8.	4.343	11.189	33.377	37.132	*******	37.300	28.520	35.475	33.860	30.663	30.323	30.080	23.219
9.	5.053	14.806	42.179	47.631	*******	48.686	31.357	45.137	40.134	33.415	35.561	34.525	25.498
10.	5.775	19.168	54.011	60.002	*******	59.199	40.028	58.281	48.371	42.382	41.100	38.907	28.572
11.	6.495	24.199	73.496	64.734	*******	65.619	73.742	69.234	55.873	71.795	45.633	43.720	31.674
12.	7.241	30.992	81.982	66.905	*******	69.788	101.570	76.985	56.141	95.467	55.841	48.420	34.855
13.	8.001	39.903	88.105	71.237	*******	74.816	120.230	81.707	62.416	107.270	62.599	53.678	38.969
14.	8.001	18.532	87.300	72.315	*******	74.773	99.014	79.679	63.216	90.304	61.528	56.063	39.735
15.	8.281	25.123	66.397	60.319	*******	62.216	61.439	65.332	56.181	65.744	54.470	29.280	48.906
16.	9.032	35.405	109.650	93.674	*******	97.506	133.970	104.340	80.467	124.650	74.431	56.908	49.082
17.	9.161	21.342	108.640	94.583	48.814	96.435	116.210	100.440	80.050	107.290	73.808	55.388	50.137
18.	9.316	28.261	75.171	69.933	*******	71.371	74.034	73.989	62.734	77.350	55.736	52.120	51.817
19.	10.078	39.787	126.970	107.400	*******	112.610	155.450	121.240	91.569	147.530	82.751	60.484	52.968
20.	10.203	25.037	125.290	107.980	*******	110.320	131.240	114.950	90.335	122.000	81.455	59.239	53.203
21.	10.361	32.754	82.756	76.633	*******	78.297	76.655	81.655	69.656	82.096	65.908	55.613	55.313
22.	11.139	45.695	143.690	123.670	*******	129.820	174.300	138.770	104.410	166.620	94.697	63.945	57.378
23.	11.267	29.329	141.480	123.550	*******	125.710	144.600	129.800	102.050	135.590	92.519	62.080	57.542
24.	11.422	37.704	87.459	83.256	*******	85.274	85.755	88.135	75.538	90.050	68.705	59.269	58.764
25.	11.550	25.909	97.716	85.167	*******	88.769	100.260	91.658	75.741	97.287	71.047	58.606	59.684
26.	11.705	32.612	78.053	72.574	*******	74.875	76.477	77.743	67.695	80.619	61.541	56.491	56.306

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITHOUT EXPLOSAFE - FILE NAME : TEST 17

DATE OF TEST = FEB 16,1984 Q IN = 65 KW/M SQ LIQUID LEVEL = 58 PERCENT

SET PRESSURE = 35 PSIG PRV ORIFICE DIAMETER = 3/8 INCHES

	TIME MINS	PRESSURE PSIG	THRM#12 C	THRM#13 C	THRM#14 C	THRM#15 C	THRM#16 C	THRM#17 C	THRM#18 C	THRM#19 C	THRM#20 C	THRM#21 C	THRM#22 C
1.	0.140	0.486	18.794	18.420	18.370	18.445	18.445	18.545	18.645	733.940	2.412	19.292	19.118
2.	0.649	0.808	19.253	18.456	18.407	18.481	18.555	18.979	19.129	763.390	2.143	19.726	19.477
3.	1.147	1.732	20.530	18.491	18.467	19.114	18.741	19.935	20.605	816.800	2.414	21.175	19.785
4.	1.752	2.900	22.055	19.003	18.754	21.188	19.276	21.659	22.253	881.320	2.415	22.673	22.005
5.	2.296	4.125	23.770	19.909	19.263	23.351	20.679	23.720	23.794	957.770	2.416	25.074	23.967
6.	2.961	5.960	27.417	21.609	20.444	26.340	23.290	26.830	25.873	*******	2.416	25.074	23.967
7.	3.647	8.275	31.354	23.969	22.439	28.945	26.353	30.115	28.091	*******	2.418	27.319	27.172
8.	4.343	11.189	37.012	27.298	24.820	33.063	29.909	34.464	31.537	*******	2.419	28.580	29.969
9.	5.063	14.806	43.080	30.896	27.997	36.978	34.091	38.893	37.026	*******	2.420	31.416	34.343
10.	5.775	19.168	49.167	34.828	31.419	40.886	38.357	43.591	42.999	*******	2.422	37.290	38.654
11.	6.495	24.199	56.427	38.584	34.816	45.043	42.844	48.828	48.366	*******	2.423	44.111	43.567
12.	7.241	30.992	63.270	42.622	38.694	50.361	47.787	53.967	58.949	*******	2.425	48.898	48.593
13.	8.001	39.903	69.642	46.672	42.705	55.576	51.493	59.925	65.441	*******	2.426	60.325	53.921
14.	8.001	18.532	52.612	49.792	43.915	55.370	55.416	54.352	56.363	*******	2.427	57.681	59.947
15.	8.281	25.123	53.148	49.046	48.812	49.865	49.491	51.008	53.381	*******	2.427	63.625	55.993
16.	9.032	35.405	73.917	53.347	51.836	57.392	56.608	58.289	63.868	*******	2.473	54.331	51.125
17.	9.161	21.342	56.173	55.526	53.906	54.879	54.485	54.115	54.532	*******	2.429	72.755	58.565
18.	9.316	28.251	55.805	52.027	51.748	52.887	52.190	53.815	56.152	*******	2.429	64.098	53.512
19.	10.078	39.787	79.267	59.132	55.355	61.513	60.598	62.106	70.461	*******	2.430	56.913	53.792
20.	10.203	25.037	74.516	58.354	57.226	57.779	57.318	57.687	58.393	*******	2.431	77.849	62.608
21.	10.361	32.754	59.435	55.452	55.290	56.352	55.821	60.030	59.654	*******	2.431	66.993	57.295
22.	11.139	45.695	87.323	60.889	59.355	65.036	63.832	69.128	79.858	*******	2.431	60.420	57.297
23.	11.267	29.329	78.931	63.539	61.395	61.715	61.761	61.281	70.256	*******	2.433	88.152	66.079
24.	11.422	37.704	83.041	58.947	58.718	60.002	59.292	63.723	63.246	*******	2.433	73.572	60.801
25.	11.550	25.909	59.249	58.812	59.547	58.675	58.215	58.261	57.525	*******	2.434	64.133	60.643
26.	11.705	32.612	61.883	56.260	56.053	57.275	56.353	60.214	59.779	*******	2.434	60.994	58.767
												60.535	58.087

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITHOUT EXPLOSAFE - FILE NAME : TEST 17

DATE OF TEST = FEB 16,1984 Q IN = 65 KW/M SQ LIQUID LEVEL = 50 PERCENT

SET PRESSURE = 35 PSIG PRV ORIFICE DIAMETER = 3/8 INCHES

	TIME MINS	PRESSURE PSIG	THRM#23 C	THRM#24 C	THRM#25 C	THRM#26 C	THRM#27 C	THRM#28 C	THRM#29 C	THRM#30 C	THRM#31 C	THRM#32 C	THRM#33 C
1.	0.140	0.486	*******	19.068	*******	18.224	18.866	18.982	19.002	19.118	19.352	18.924	19.118
2.	0.649	0.808	*******	19.203	*******	18.723	20.918	20.821	21.616	19.889	21.403	22.765	22.779
3.	1.147	1.732	*******	19.537	*******	19.495	24.825	25.366	27.547	24.806	27.316	34.850	32.741
4.	1.752	2.900	*******	20.171	*******	20.231	30.741	33.985	38.405	37.201	39.340	55.084	50.267
5.	2.296	4.125	*******	22.066	*******	20.943	36.545	43.868	51.187	52.832	53.493	74.809	69.006
6.	2.961	5.960	*******	24.989	*******	22.453	42.819	59.199	69.490	75.868	73.595	100.770	93.878
7.	3.647	8.275	*******	28.140	*******	24.096	50.559	76.982	92.270	102.700	95.388	127.330	120.170
8.	4.343	11.189	*******	31.925	*******	25.872	58.217	97.137	118.710	131.880	118.270	156.340	147.190
9.	5.053	14.806	*******	35.970	*******	28.107	66.285	119.770	147.430	162.440	142.270	186.940	174.870
10.	5.775	19.168	*******	40.457	*******	30.857	75.195	145.370	179.330	193.570	164.100	216.830	205.030
11.	6.495	24.199	*******	45.043	*******	33.945	78.906	167.060	207.070	224.100	190.610	245.620	229.020
12.	7.241	30.992	41.602	50.011	*******	37.100	82.635	174.810	219.780	255.000	213.530	273.690	257.000
13.	8.001	39.903	*******	55.160	*******	41.087	86.024	188.360	238.410	285.710	224.780	301.700	287.510
14.	8.001	18.532	*******	52.286	*******	41.508	49.826	178.920	231.590	290.740	242.250	305.300	290.710
15.	8.281	25.123	*******	50.822	*******	47.384	54.628	170.010	221.000	296.690	234.940	310.890	296.160
16.	9.032	35.405	*******	57.115	*******	50.697	76.318	201.170	257.090	325.650	263.760	334.820	322.300
17.	9.161	21.342	*******	54.532	*******	51.002	52.458	194.720	253.830	330.440	265.280	339.190	326.590
18.	9.316	28.251	*******	53.073	*******	53.424	58.080	186.270	249.060	336.260	259.550	345.710	332.220
19.	10.078	39.787	*******	60.392	*******	55.854	93.755	225.450	290.390	364.700	293.330	366.210	356.000
20.	10.203	25.037	*******	57.802	*******	55.122	56.780	216.520	285.820	368.930	275.690	372.210	359.410
21.	10.361	32.754	*******	56.744	*******	57.479	65.553	206.300	277.330	374.590	281.490	376.480	364.290
22.	11.139	45.695	*******	65.013	*******	60.262	115.630	250.400	323.350	401.890	296.800	398.210	386.910
23.	11.267	29.329	*******	61.052	*******	60.189	61.523	237.140	317.370	406.190	299.890	402.340	390.830
24.	11.422	37.704	*******	60.460	*******	61.301	71.111	223.610	305.370	411.360	310.160	404.070	395.000
25.	11.550	25.909	*******	58.881	*******	60.740	59.556	220.370	303.080	415.600	312.490	407.640	398.850
26.	11.705	32.612	*******	57.919	*******	58.957	69.940	219.200	301.960	420.700	315.140	411.420	403.280

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITHOUT EXPLOSAFE - FILE NAME : TEST 17

DATE OF TEST = FEB 16,1984 Q IN = 65 KW/M SQ LIQUID LEVEL = 58 PERCENT

SET PRESSURE = 35 PSIG PRV ORIFICE DIAMETER = 3/8 INCHES

	TIME MINS	PRESSURE PSIG	THRM#34 C	THRM#35 C	THRM#36 C	THRM#37 C	THRM#38 C	THRM#39 C	THRM#40 C	THRM#41 C	THRM#42 C	THRM#43 C
1.	0.140	0.486	19.138	18.613	19.177	19.255	18.807	*******	2.356	19.818	20.129	19.818
2.	0.649	0.808	21.655	20.045	20.841	22.469	20.064	131.520	2.357	19.831	20.142	19.812
3.	1.147	1.732	26.138	21.824	24.535	28.588	21.126	*******	2.359	19.787	20.156	19.826
4.	1.752	2.900	34.349	23.894	31.413	38.806	22.520	17.139	2.360	19.920	20.192	19.901
5.	2.296	4.125	43.431	25.319	39.010	49.920	24.468	*******	2.362	19.933	20.203	20.089
6.	2.861	5.960	57.186	28.268	50.163	66.048	26.050	*******	2.363	20.048	20.514	20.514
7.	3.647	8.275	74.487	28.863	63.347	85.150	29.383	*******	2.365	20.142	20.977	21.268
8.	4.343	11.189	94.685	30.881	78.319	106.770	32.072	*******	2.367	20.159	21.750	22.429
9.	5.053	14.806	118.450	33.912	94.794	130.730	35.751	*******	2.368	20.060	22.911	24.014
10.	5.775	19.168	141.070	37.890	107.960	147.660	39.895	*******	2.370	20.038	24.476	26.253
11.	6.495	24.199	160.240	40.674	126.640	169.700	43.891	*******	2.372	20.132	26.462	28.737
12.	7.241	30.992	171.760	44.857	146.660	181.900	48.538	*******	2.373	20.206	28.965	31.773
13.	8.001	38.903	188.750	49.331	165.970	199.490	53.774	*******	2.375	20.204	32.097	35.701
14.	8.001	18.532	180.730	47.249	151.950	183.200	48.235	*******	2.375	21.099	32.617	36.029
15.	8.201	25.123	173.840	52.514	146.490	178.660	52.741	*******	2.376	20.985	33.311	36.950
16.	9.032	35.405	200.740	57.359	179.360	219.250	59.090	*******	2.377	20.789	37.043	41.014
17.	9.161	21.342	196.150	52.156	166.270	205.730	52.288	147.090	2.378	21.568	37.734	41.798
18.	9.316	28.251	191.300	56.385	160.970	203.660	56.140	*******	2.378	21.416	38.539	43.000
19.	10.078	39.787	224.230	61.291	201.010	246.110	62.774	*******	2.380	21.102	43.016	47.764
20.	10.203	25.037	216.290	55.763	185.370	229.720	56.083	*******	2.380	22.404	43.780	48.733
21.	10.361	32.754	211.750	59.323	179.760	224.790	59.511	*******	2.380	21.766	44.732	49.872
22.	11.139	45.695	250.360	65.196	224.590	272.190	66.863	*******	2.382	21.435	50.022	55.349
23.	11.267	29.329	239.180	59.983	203.650	251.160	60.039	*******	2.382	23.898	50.876	56.313
24.	11.422	37.704	232.540	63.459	196.080	244.960	63.421	*******	2.382	22.197	51.900	57.164
25.	11.550	26.909	227.100	57.844	187.450	236.300	57.468	*******	2.383	23.846	52.791	58.089
26.	11.705	32.612	227.460	59.822	189.310	241.690	59.897	*******	2.383	22.630	53.870	59.221

PLOTS OF A TEST

CARRIED OUT ON THE UNB TANK 2

WITHOUT EXPLOSAFE

TEST NUMBER 18

Q in = 65 kW/m sq

LIQUID LEVEL = 23 %

SET PRESSURE = 35 psig

PRV ORIFICE DIAMETER = 3/8 in.

Date of Test FEB 20, 1984

TABLE OF CONTENTS

Thermocouple Grid Layout - - - - - - - - - - - - -

1. For the Thermocouples Placed in a Vertical Line:
   (a) Plots of Temperature Vs Time - - - - - - - -
   (b) Plots of Height Vs. Temperature - - - - - - -

2. Thermocouples Placed in the Four Quadrants
   in a Vertical Plane: Temp. Vs. Time - - - - - -

Thermocouple Grid Layout - - - - - - - - - - - - -

3. Thermocouples Placed On and Inside the
   Mild Steel Shell: Temp. Vs. Time - - - - - - -

4. Thermocouples Placed in the Lava Medium
   Temp. Vs. Time - - - - - - - - - - - - - - - -

6. Print out of Data - - - - - - - - - - - - - -

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Thermocouple Grid Layout - - - - - - - - - - - - -

1. For the Thermocouples Placed in a Vertical Line:

   (a) Plots of Temperature Vs Time - - - - - - - -

   (b) Plots of Height Vs. Temperature - - - - - - -

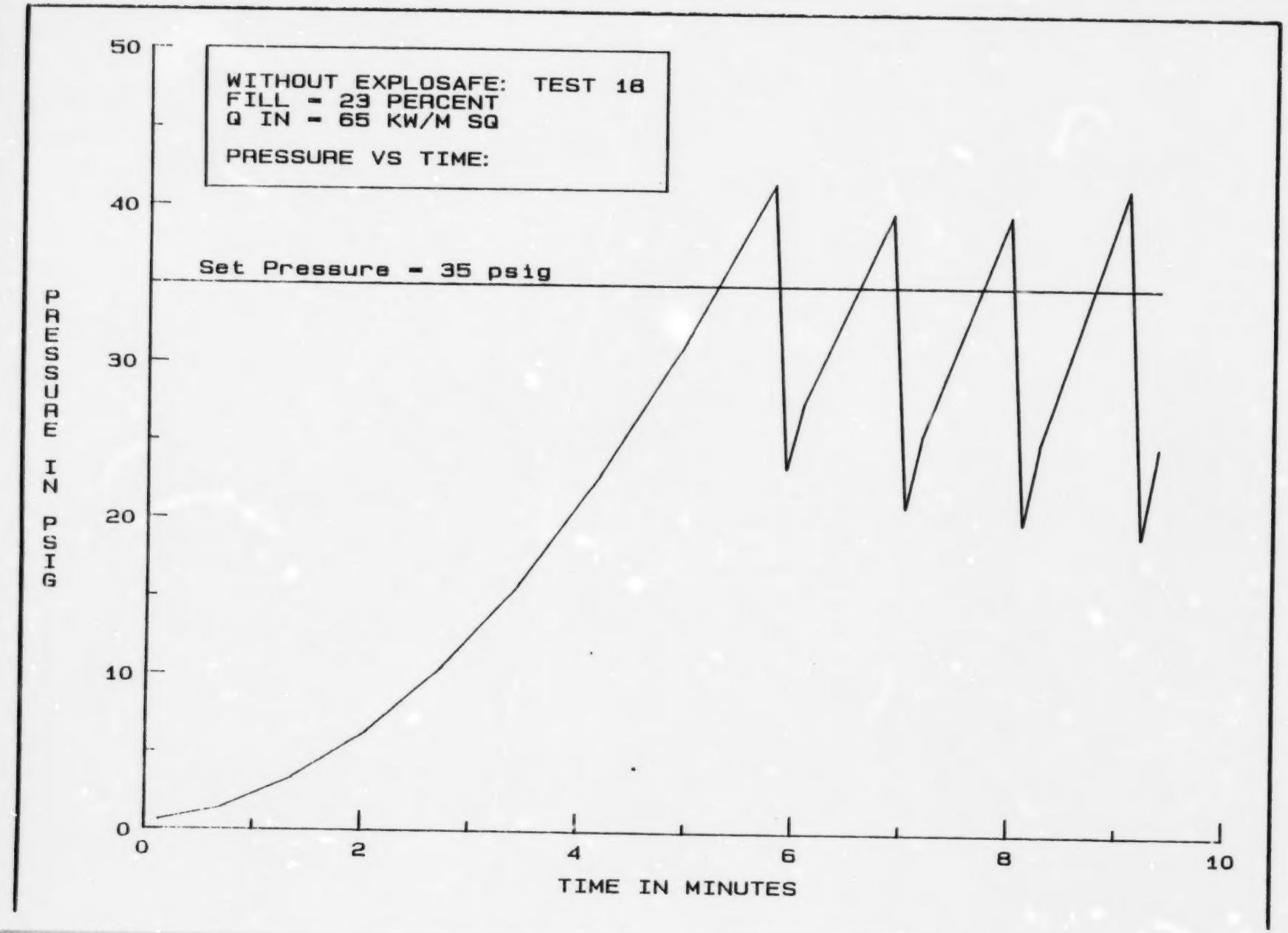
2. Thermocouples Placed in the Four Quadrants in a Vertical Plane: Temp. Vs. Time - - - - - -

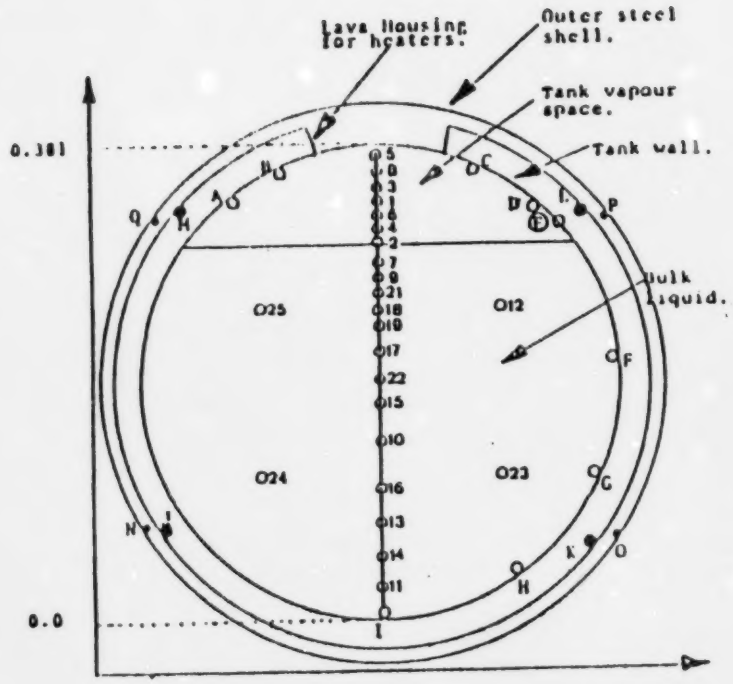
Thermocouple Grid Layout - - - - - - - - - - - -

3. Thermocouples Placed On and Inside the Mild Steel Shell: Temp. Vs. Time - - - - - - -

4. Thermocouples Placed in the Lava Medium Temp. Vs. Time - - - - - - - - - - - - - - - -

5. Thermocouples Placed Inside the Gutter Shell Temp. Vs. Time - - - - - - - - - - - - - -


WITHOUT EXPLOSAFE: TEST 18
FILL = 23 PERCENT
Q IN = 65 KW/M SQ
PRESSURE VS TIME:
Set Pressure = 35 psig
PRESSURE IN PSIG
50
40
30
20
10
0
0
2
4
6
8
10
TIME IN MINUTES



SYMBOL	Thermocouple #	Angle(Deg)
A	28	310
B & C	37 & 29	340 & 22
D & E	36 & 34	55 & 56
F & G	27 & 38	92 & 116
H & I	35 & 26	144 & 180
J & K	30 & 31	133 & 220
L & M	32 & 33	50 & 300
N & O	42 & 43	140 & 230
P & Q	39 & 41	60 & 310

Number 45 represents time in seconds.
Number 44 represents pressure in psig.
Reference upper diameter = 48.37 cms.

Thermocouple numbers.	Height (cm)	Angle with the vertical (Deg.)	Doubtful or faulty Thermocouple.
05	45.88	-	-
08	44.905	-	-
03	43.63	-	YES
01	42.715	-	-
06	41.805	-	-
04	40.745	-	-
02	39.885	-	-
07	37.765	-	-
09	36.845	-	-
21	35.705	-	-
18	34.84	-	-
19	33.86	-	YES
17	31.72	-	-
22	29.635	-	-
15	27.665	-	-
10	25.585	-	-
16	24.585	-	-
13	21.02	-	-
14	16.94	-	-
11	12.81	-	-
26	10.255	180	-
29 & 36	-	22 & 55	-
28 & 37	-	310 & 340	-
27 & 38	-	92 & 116	-
35	-	144	-
30 & 31	-	133 & 220	-
32 & 33	-	50 & 300	-
39 & 41	-	60 & 310	-
42 & 43	-	140 & 230	-
34	-	56	YES
23 & 25	-	-	YES
12	32.20	-	-
24	24.85	-	-
20 & 40	Reference temperature	-	-

◯ Circled thermocouple is inserted inside the vapour space wall.

Fig. III.B A grid layout of thermocouples along with their locations for an unprotected vessel(UNB) with the PRV orifice of 3/8 in. (Valid for 76, 58 and 23 percent liquid full cases)

FOLLOWING THERMOCOUPLES ARE PLACED

AT THE CENTRE OF THE VESSEL (DIA. 38.1 CM)

IN A VERTICLE AXIS

THERMOCOUPLE NUM.	HEIGHT FROM BOTTOM IN cm
28 OR I	0
11	2.555
14	6.685
13	10.765
16	14.33
10	15.33
15	17.41
22	19.38
17	21.465
18	24.585
21	25.45
9	26.59
7	27.51
2	29.63
4	30.49
6	31.55
1	32.48
8	34.65
5	35.625

PLOTS ARE GIVEN TWO PER PAGE

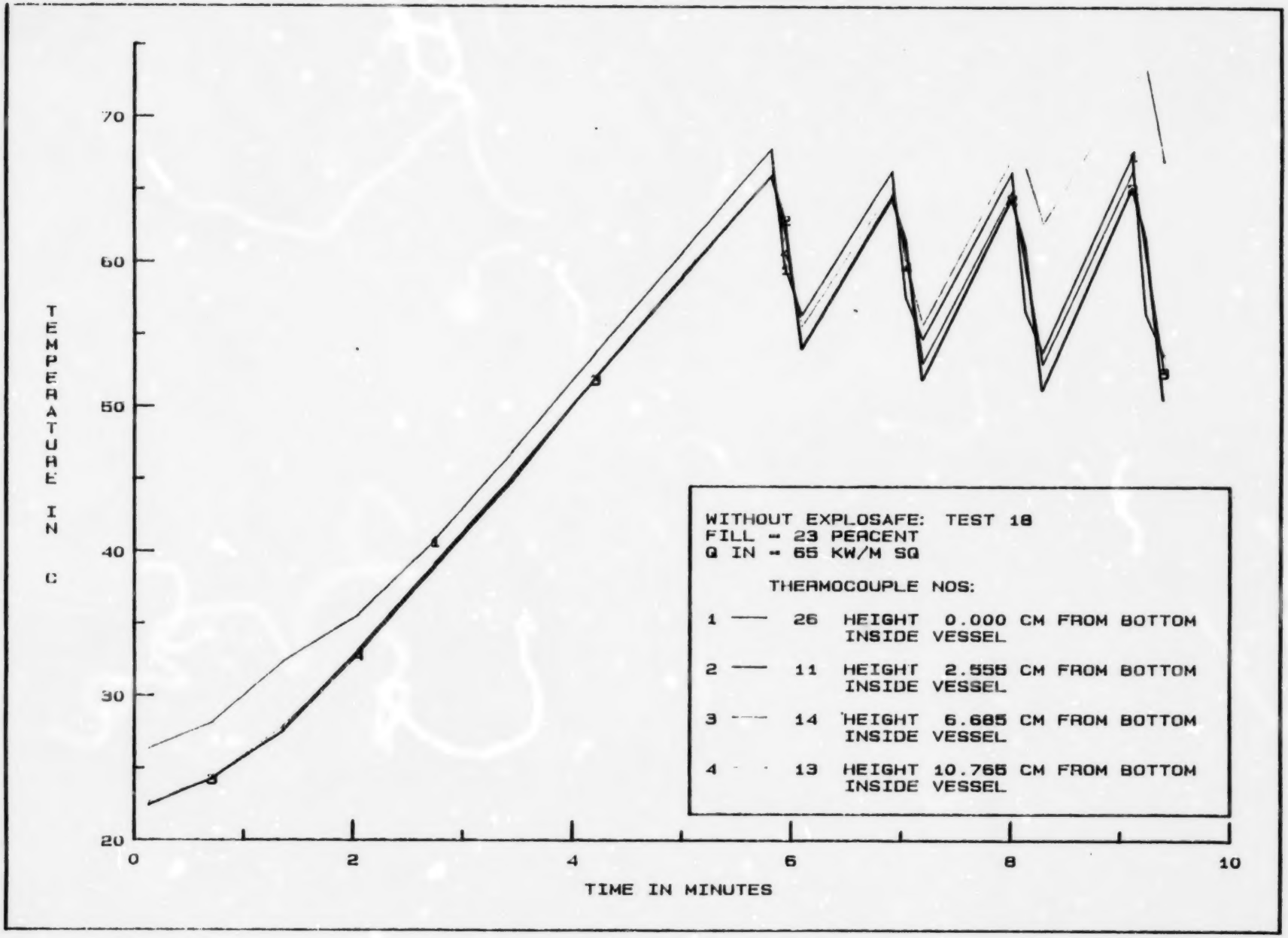
FOLLOWING THERMOCOUPLES ARE PLACED

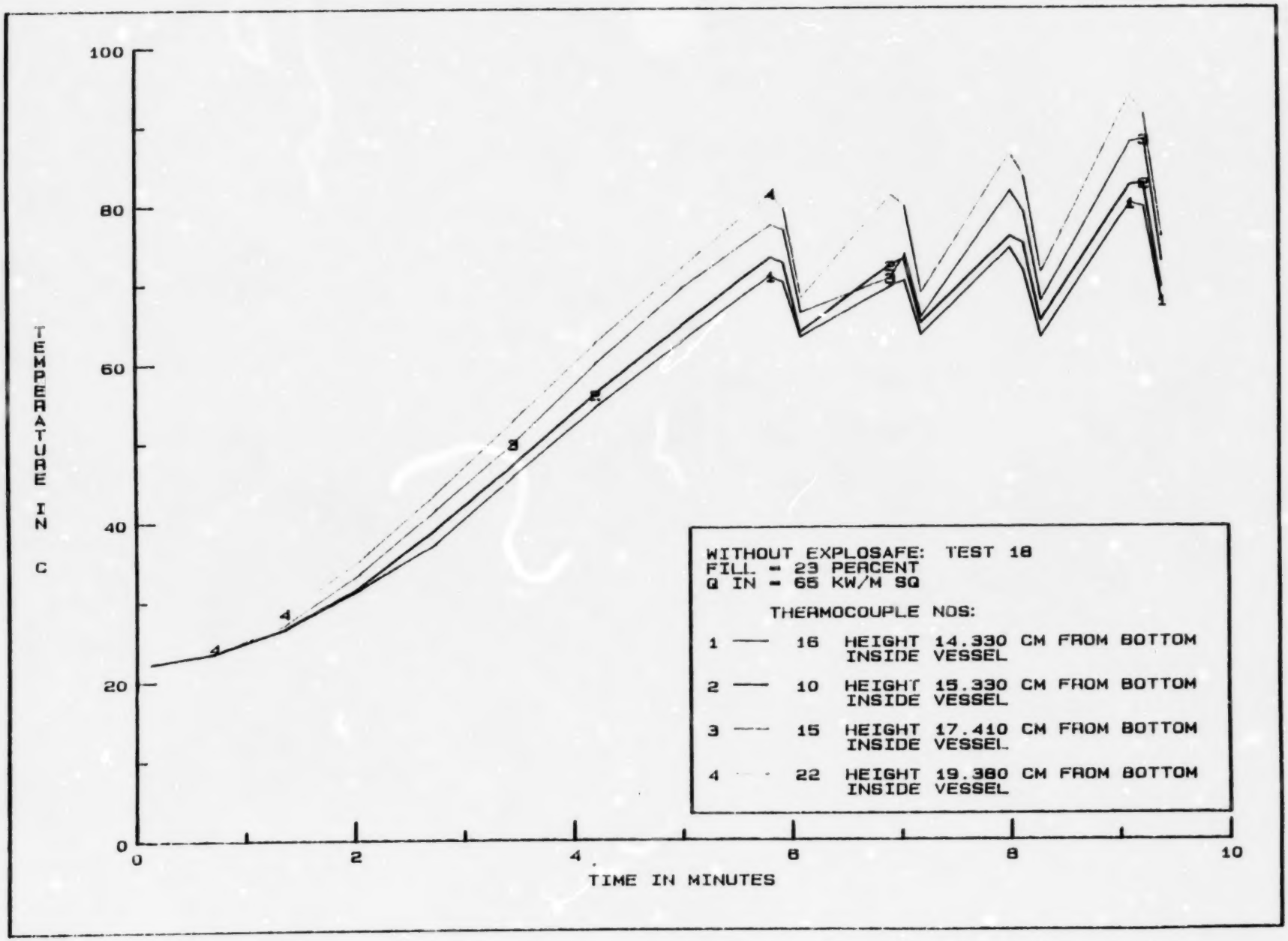
AT THE CENTRE OF THE VESSEL (DIA. 38.1 CM)

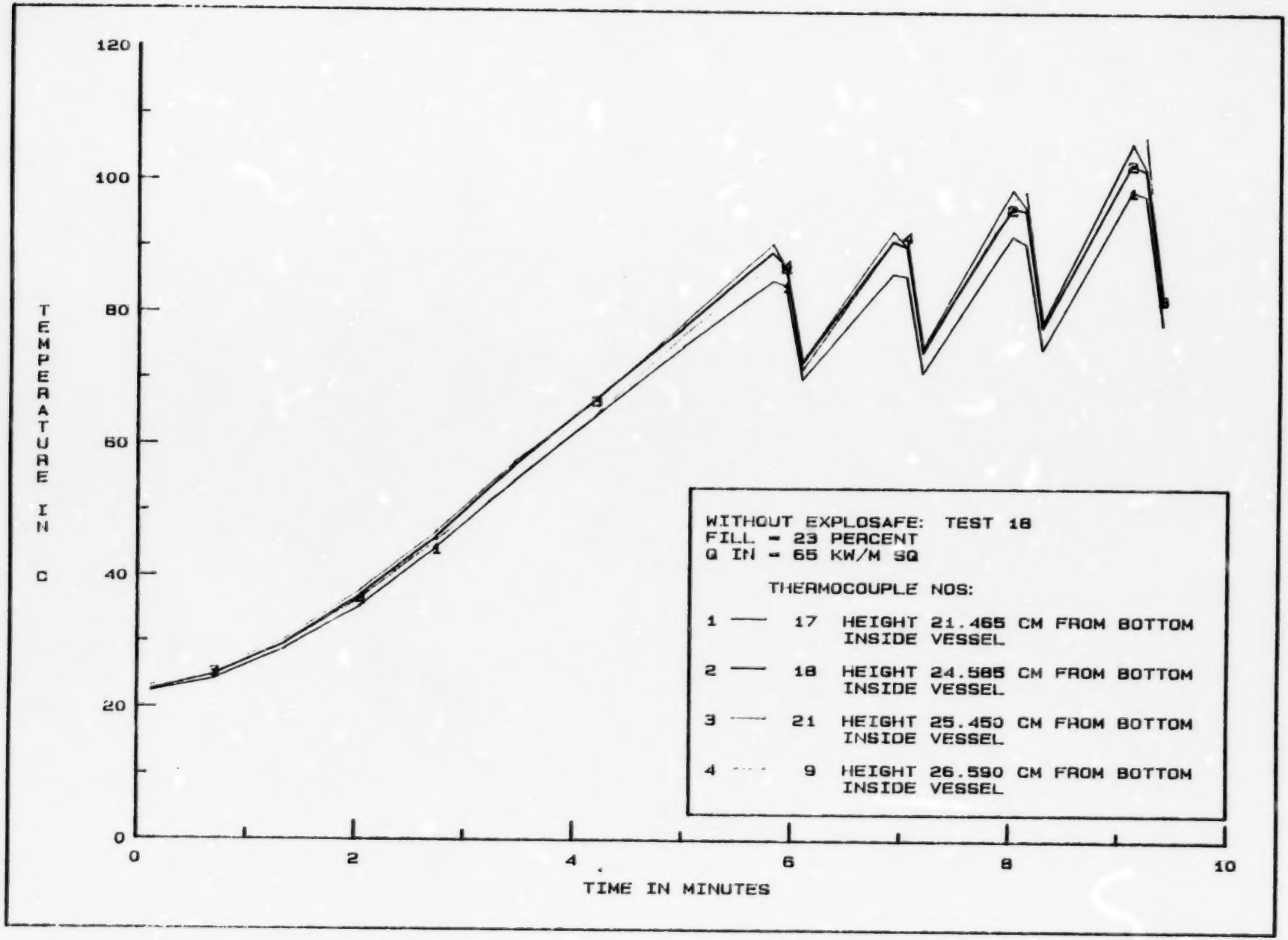
IN A VERTICLE AXIS

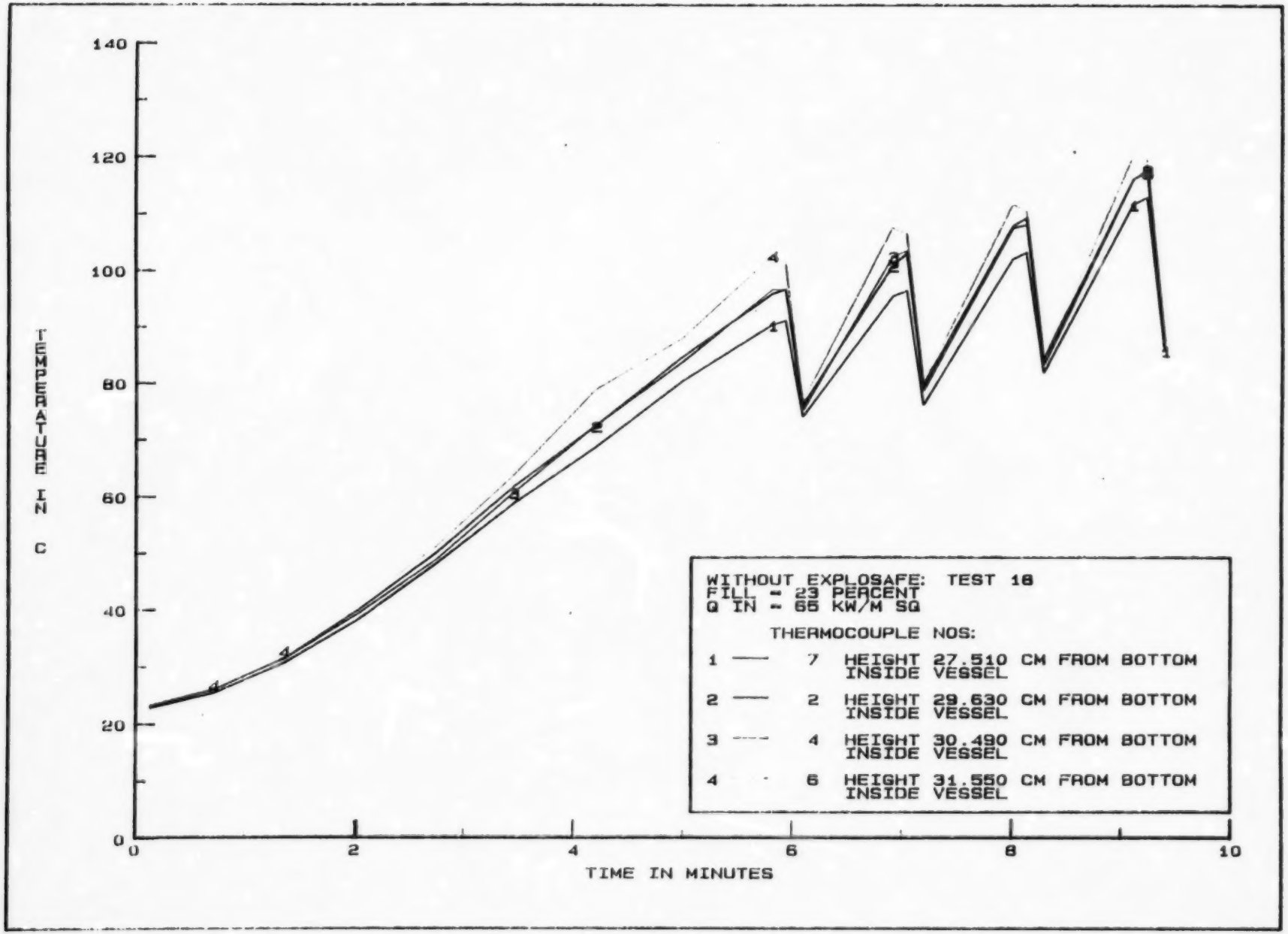
THERMOCOUPLE NUM.	HEIGHT FROM BOTTOM IN cm
26 CR I	0
11	2.555
14	6.685
13	10.765
16	14.33
10	15.33
15	17.41
22	19.38
17	21.465
18	24.585
21	25.45
9	26.59
7	27.51
2	29.63
4	30.49
6	31.55
1	32.46
8	34.65
5	35.625

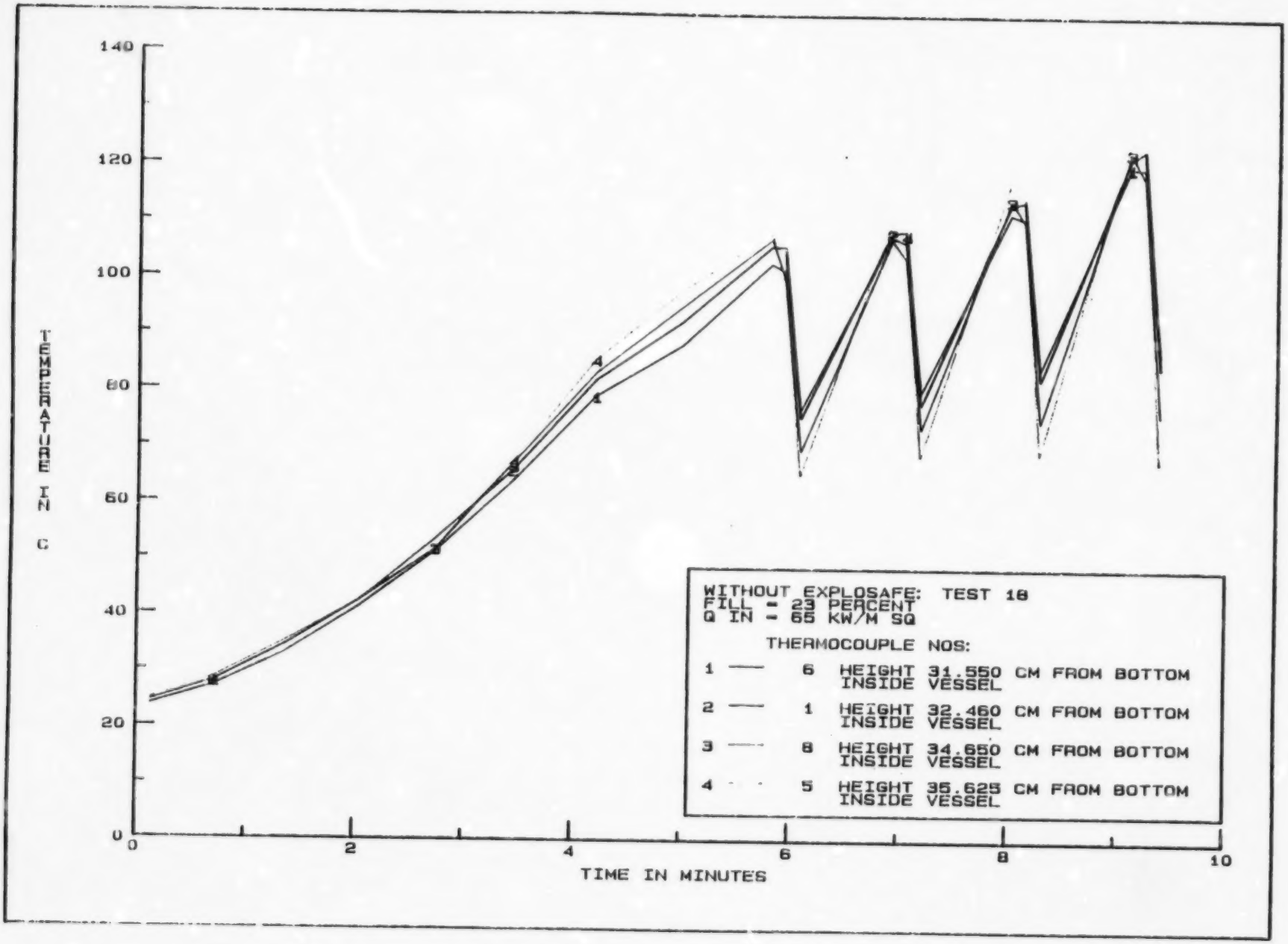
PLOTS ARE GIVEN TWO PER PAGE


TEMPERATURE IN C
70
60
50
40
30
20
0
2
4
6
8
10
TIME IN MINUTES
WITHOUT EXPLOSAFE: TEST 18
FILL - 23 PERCENT
Q IN - 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 26 HEIGHT 0.000 CM FROM BOTTOM INSIDE VESSEL
2 —— 11 HEIGHT 2.555 CM FROM BOTTOM INSIDE VESSEL
3 —— 14 HEIGHT 6.685 CM FROM BOTTOM INSIDE VESSEL
4 - - 13 HEIGHT 10.765 CM FROM BOTTOM INSIDE VESSEL


100
80
60
40
20
0
TEMPERATURE IN C
0
2
4
6
8
10
TIME IN MINUTES
WITHOUT EXPLOSAFE: TEST 18
FILL - 23 PERCENT
Q IN - 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 16 HEIGHT 14.330 CM FROM BOTTOM INSIDE VESSEL
2 —— 10 HEIGHT 15.330 CM FROM BOTTOM INSIDE VESSEL
3 —— 15 HEIGHT 17.410 CM FROM BOTTOM INSIDE VESSEL
4 —— 22 HEIGHT 19.380 CM FROM BOTTOM INSIDE VESSEL


120
100
80
60
40
20
0
TEMPERATURE IN C
0
2
4
6
8
10
TIME IN MINUTES
WITHOUT EXPLOSAFE: TEST 18
FILL - 23 PERCENT
Q IN - 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 17 HEIGHT 21.465 CM FROM BOTTOM INSIDE VESSEL
2 —— 18 HEIGHT 24.585 CM FROM BOTTOM INSIDE VESSEL
3 —— 21 HEIGHT 25.450 CM FROM BOTTOM INSIDE VESSEL
4 ---- 9 HEIGHT 26.590 CM FROM BOTTOM INSIDE VESSEL


140
120
100
80
60
40
20
0
TEMPERATURE IN C
0
2
4
6
8
10
TIME IN MINUTES
WITHOUT EXPLOSAFE: TEST 18
FILL - 23 PERCENT
Q IN - 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 7 HEIGHT 27.510 CM FROM BOTTOM INSIDE VESSEL
2 —— 2 HEIGHT 29.630 CM FROM BOTTOM INSIDE VESSEL
3 - - - 4 HEIGHT 30.490 CM FROM BOTTOM INSIDE VESSEL
4 · 6 HEIGHT 31.550 CM FROM BOTTOM INSIDE VESSEL


140
120
100
80
60
40
20
0
TEMPERATURE IN C
0
2
4
6
8
10
TIME IN MINUTES
WITHOUT EXPLOSAFE: TEST 18
FILL = 23 PERCENT
Q IN = 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 6 HEIGHT 31.550 CM FROM BOTTOM INSIDE VESSEL
2 —— 1 HEIGHT 32.460 CM FROM BOTTOM INSIDE VESSEL
3 —— 8 HEIGHT 34.650 CM FROM BOTTOM INSIDE VESSEL
4 - - 5 HEIGHT 35.625 CM FROM BOTTOM INSIDE VESSEL

FOLLOWING ARE HEIGHT VS TEMPERATURE

PLOTS FOR THE

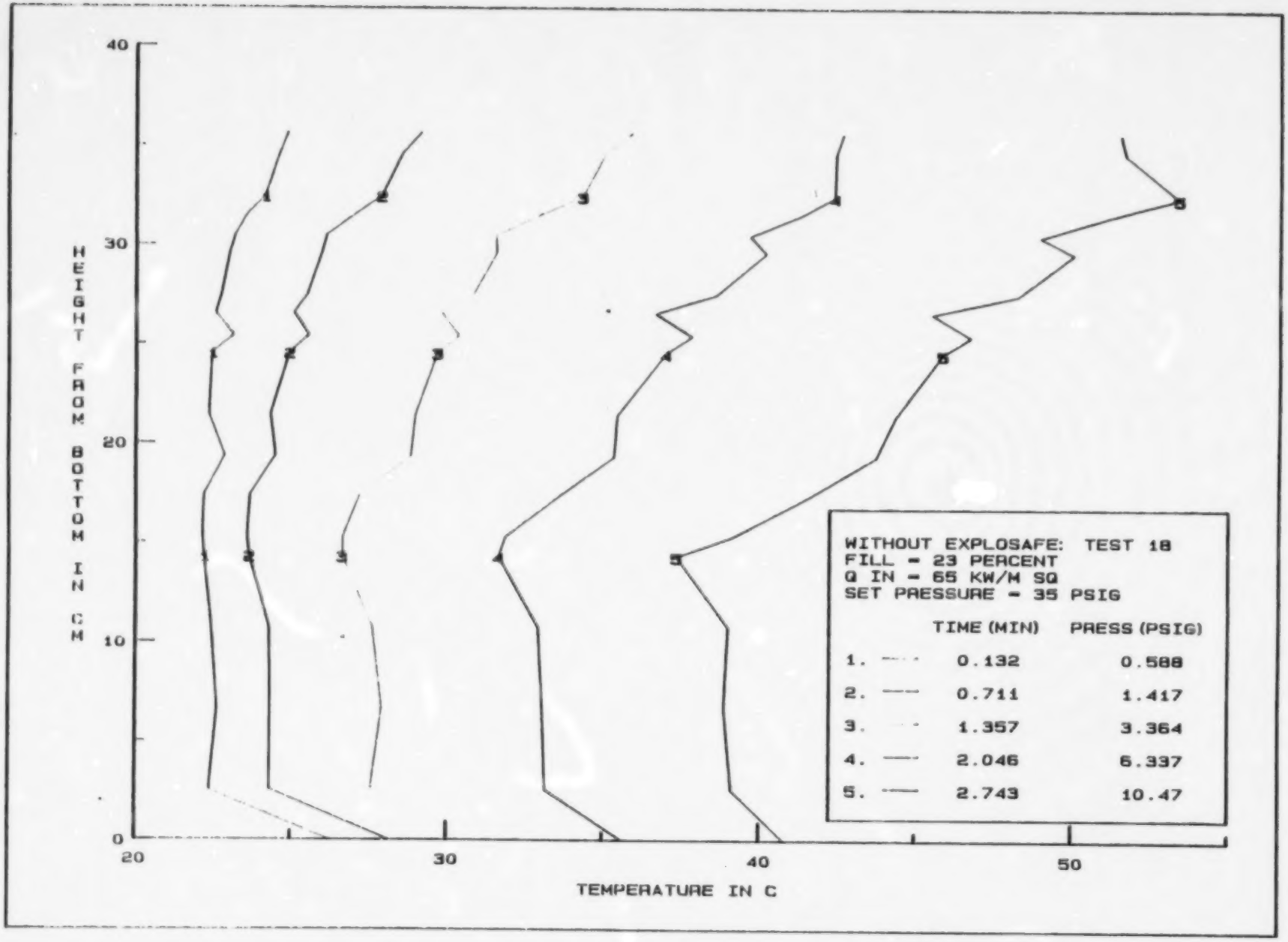
THERMOCOUPLES PLACED AT THE CENTRE

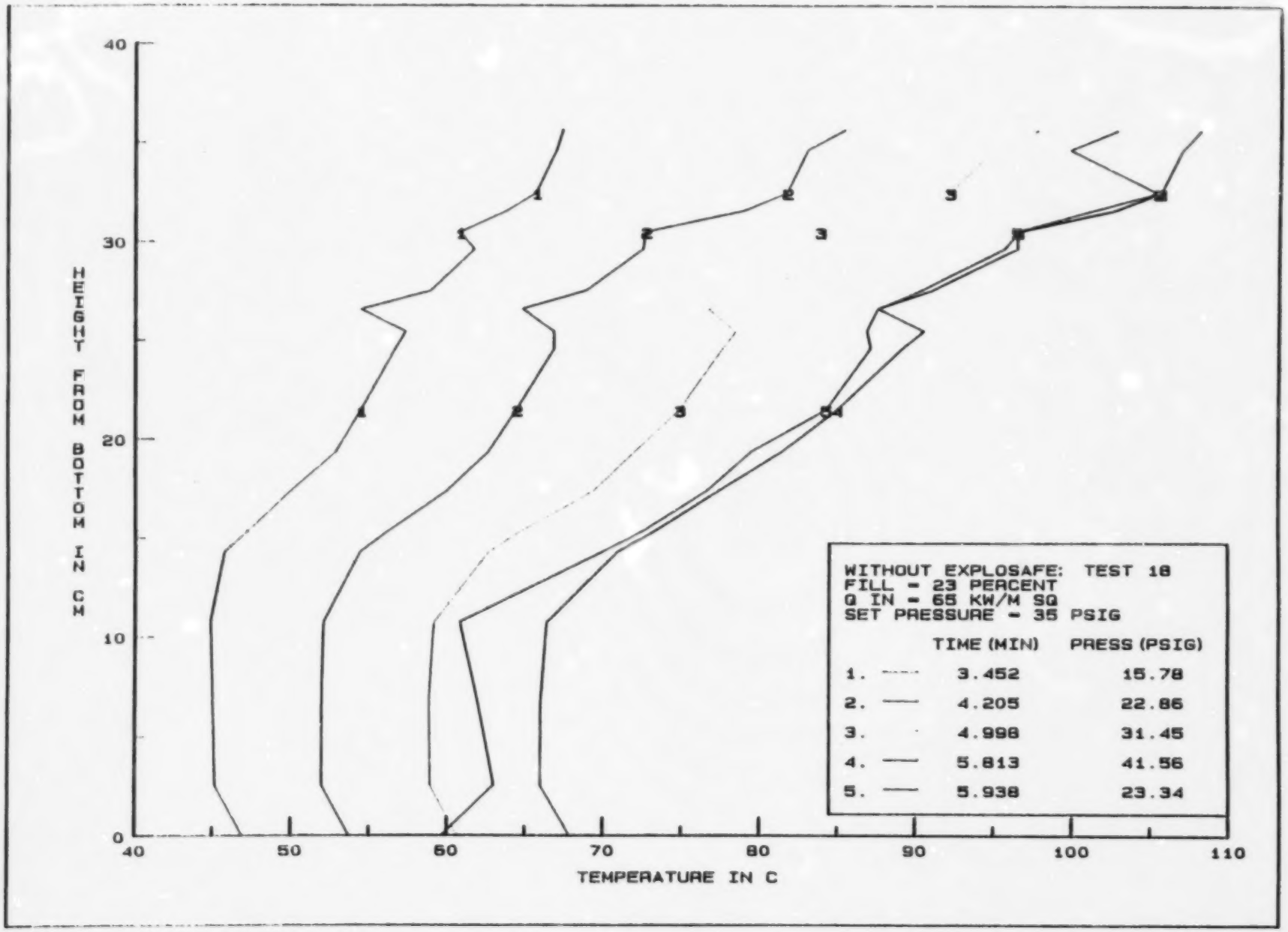
OF THE VESSEL

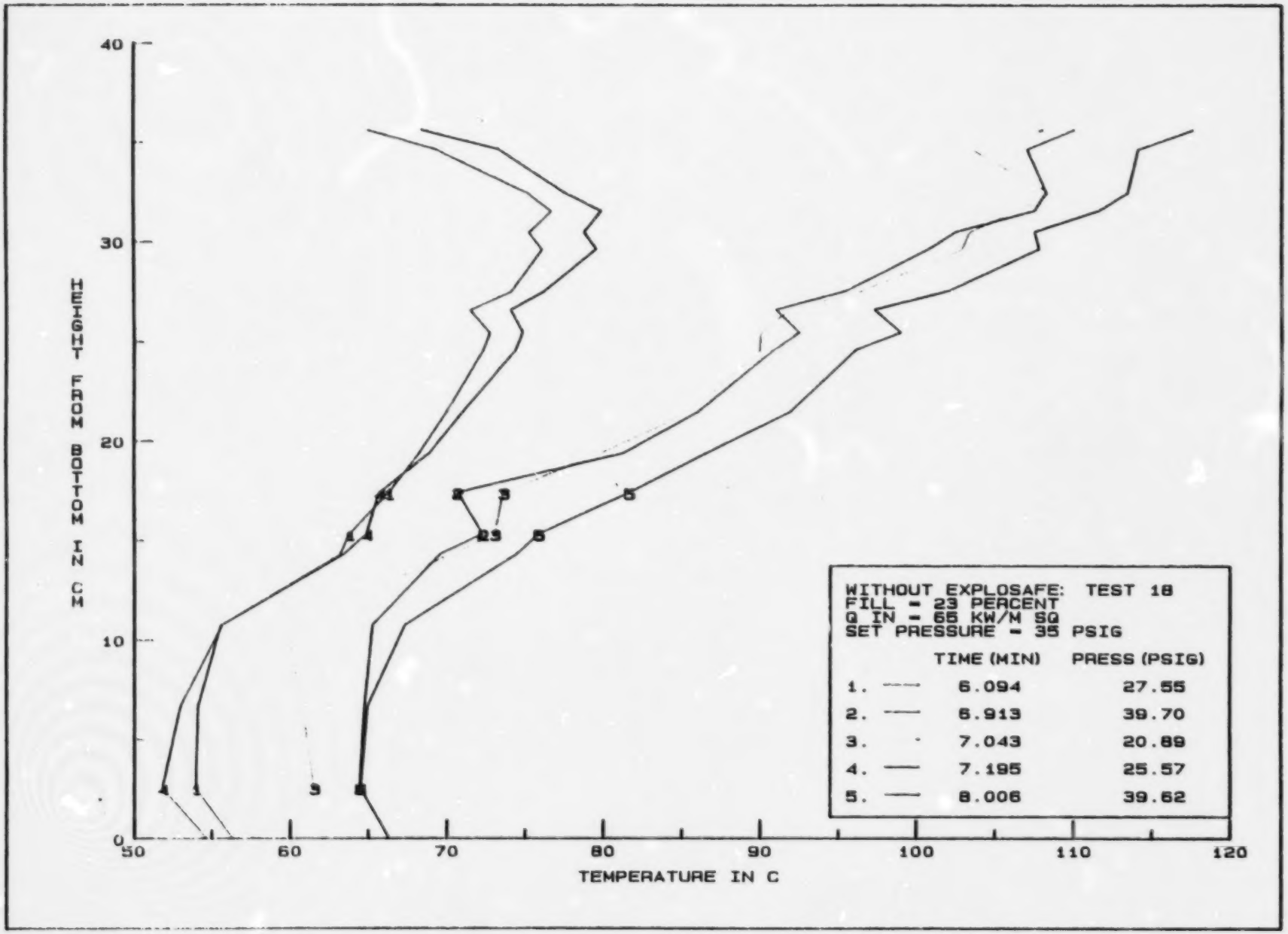
IN A VERTICAL AXIS.

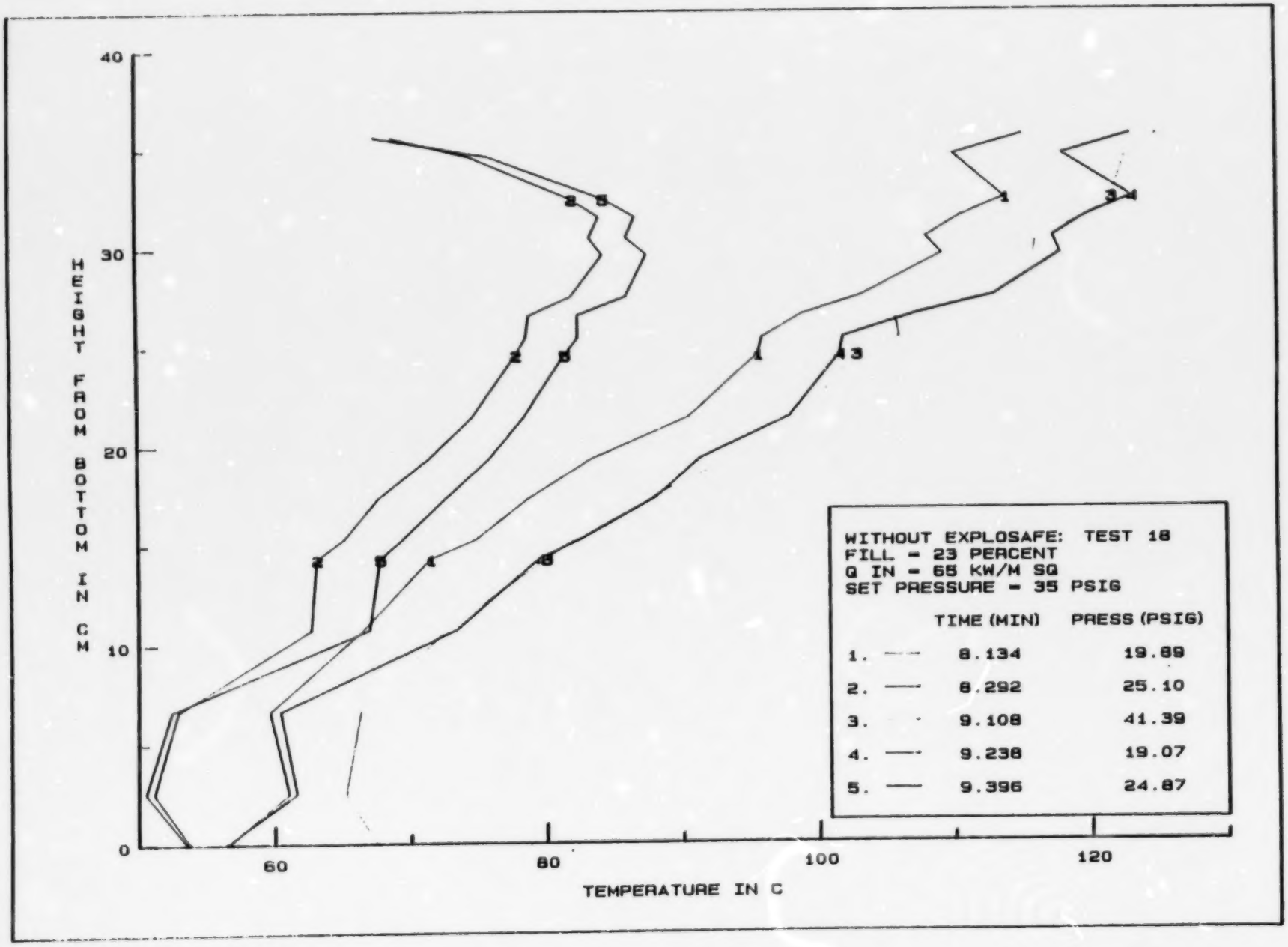
* EACH PLOT REPRESENTS ONE SCAN OF ALL THE THERMOCOUPLES

* PLOTS ARE GIVEN AS FIVE (5) SCANS PER PAGE


HEIGHT FROM BOTTOM IN CM
40
30
20
10
0
20
30
40
50
TEMPERATURE IN C
WITHOUT EXPLOSAFE: TEST 18
FILL - 23 PERCENT
Q IN - 65 KW/M SQ
SET PRESSURE - 35 PSIG
TIME (MIN) PRESS (PSIG)
1. 0.132 0.588
2. 0.711 1.417
3. 1.357 3.364
4. 2.046 6.337
5. 2.743 10.47

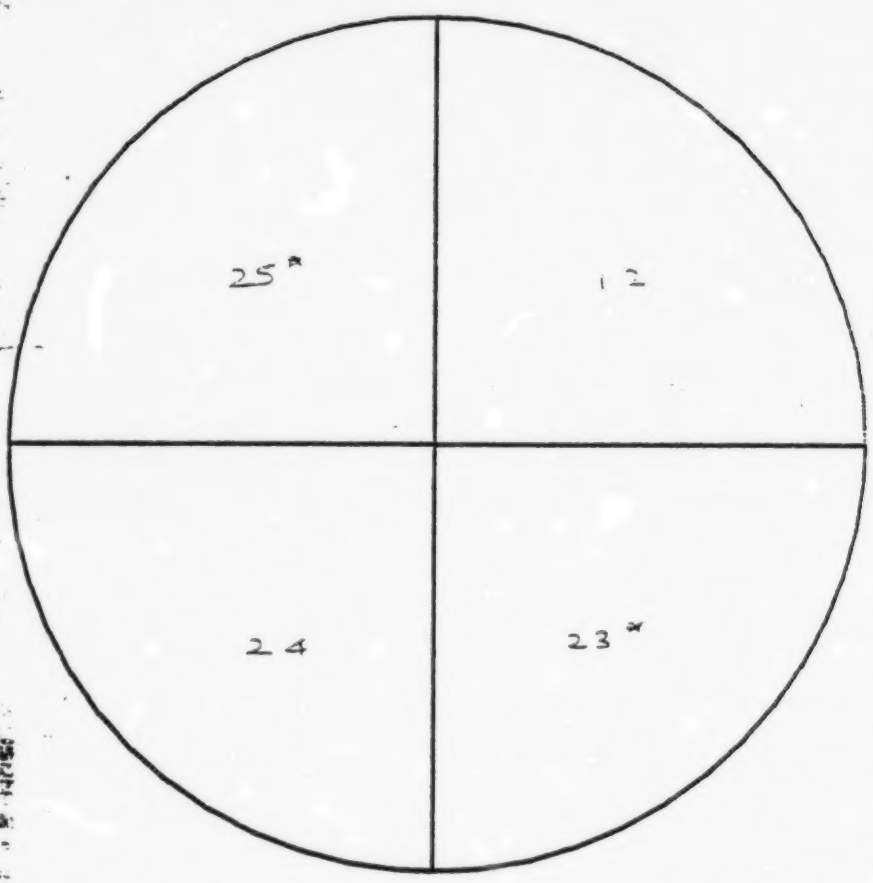

HEIGHT FROM BOTTOM IN CM
TEMPERATURE IN C
0
10
20
30
40
40
50
60
70
80
90
100
110
WITHOUT EXPLOSAFE: TEST 18
FILL - 23 PERCENT
Q IN - 65 KW/M SQ
SET PRESSURE - 35 PSIG
TIME (MIN) PRESS (PSIG)
1. 3.452 15.78
2. 4.205 22.86
3. 4.998 31.45
4. 5.813 41.56
5. 5.938 23.34


HEIGHT FROM BOTTOM IN CM
TEMPERATURE IN C
0
10
20
30
40
50
60
70
80
90
100
110
120
WITHOUT EXPLOSAFE: TEST 18
FILL - 23 PERCENT
Q IN - 65 KW/M SQ
SET PRESSURE - 35 PSIG
TIME (MIN) PRESS (PSIG)
1. 6.094 27.55
2. 6.913 39.70
3. 7.043 20.89
4. 7.195 25.57
5. 8.006 39.62


HEIGHT FROM BOTTOM IN CM
40
30
20
10
0
60
80
100
120
TEMPERATURE IN C
WITHOUT EXPLOSAFE: TEST 18
FILL - 23 PERCENT
Q IN - 65 KW/M SQ
SET PRESSURE - 35 PSIG
TIME (MIN) PRESS (PSIG)
1. 8.134 19.89
2. 8.292 25.10
3. 9.108 41.39
4. 9.238 19.07
5. 9.396 24.87

FOLLOWING FOUR THERMOCOUPLES ARE PLACED

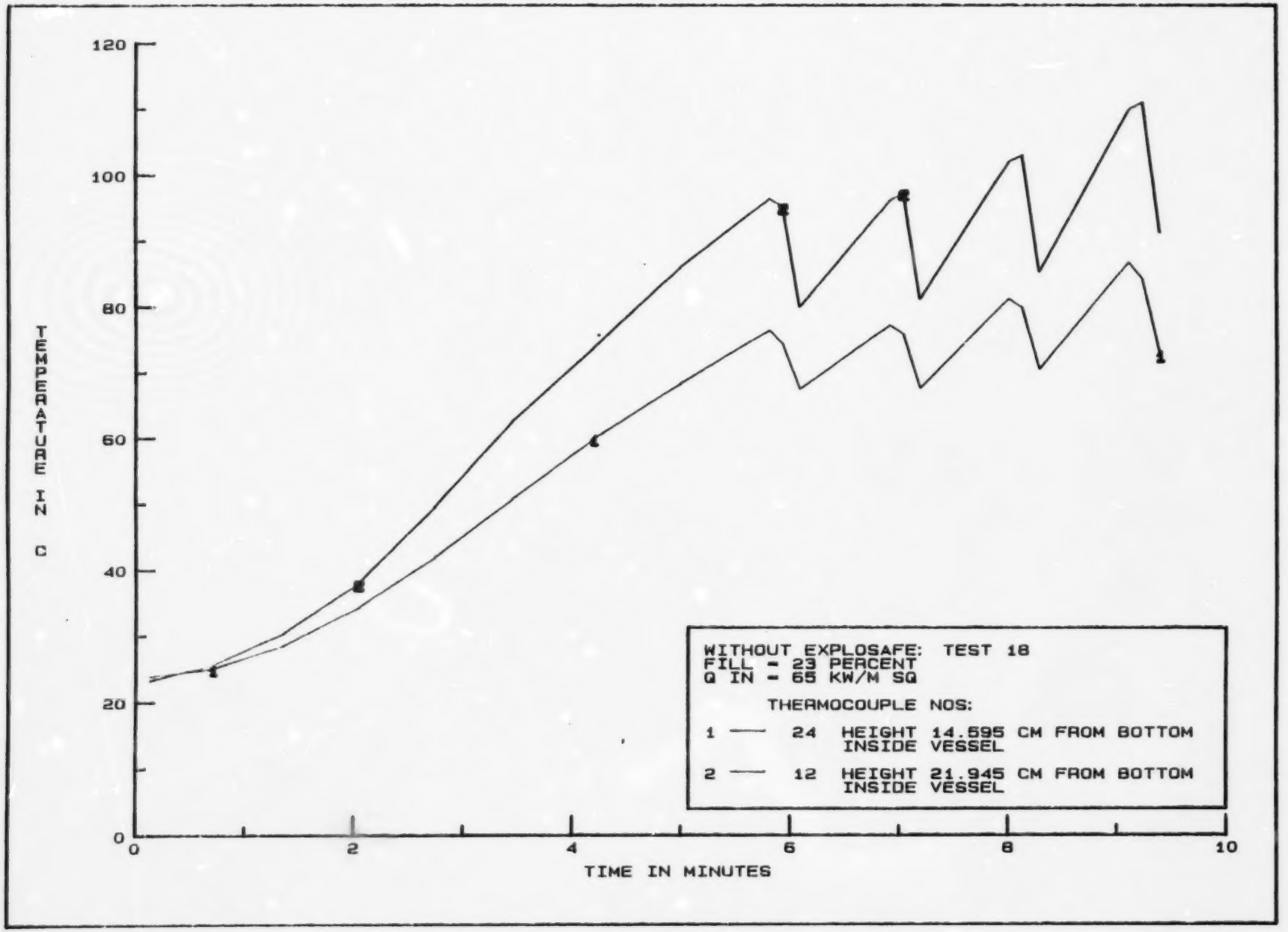
AT THE FOUR QUADRANTS ON A VERTICAL PLANE

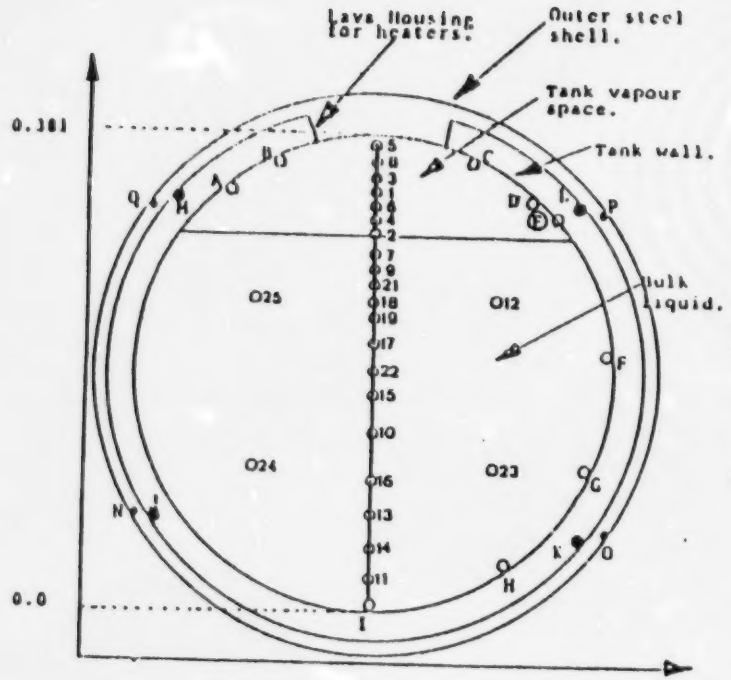


THERMOCOUPLE NUM.	HEIGHT FROM BOTTOM IN cm
24 AND 23	14.595
25 AND 12	21.945

PLOTS ARE GIVEN TWO PER PAGE

* Thermocouple Nos. 23 and 25 were FAULTY during experiment ***


120
100
80
60
40
20
0
TEMPERATURE IN C
0
2
4
6
8
10
TIME IN MINUTES
WITHOUT EXPLOSAFE: TEST 18
FILL - 23 PERCENT
Q IN - 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 24 HEIGHT 14.595 CM FROM BOTTOM INSIDE VESSEL
2 —— 12 HEIGHT 21.945 CM FROM BOTTOM INSIDE VESSEL



SYMBOL	Thermocouple #	Angle(Deg)
A	28	310
B & C	37 & 29	340 & 22
D & E	36 & 34	55 & 56
F & G	27 & 38	92 & 116
H & I	35 & 26	144 & 180
J & K	30 & 31	133 & 220
L & M	32 & 33	50 & 300
N & O	42 & 43	140 & 230
P & Q	39 & 41	60 & 310

○ Circled thermocouple is inserted inside the vapour space wall.

Number 45 represents time in seconds.
Number 44 represents pressure in psig.
Reference upper diameter = 48.37 cms.

Thermocouple numbers.	Height (cm)	Angle with the vertical (Deg.)	Doubtful or faulty Thermocouple.
05	45.88	-	-
08	44.005	-	-
03	43.63	-	YES
01	42.715	-	-
06	41.805	-	-
04	40.745	-	-
02	39.885	-	-
07	37.765	-	-
09	36.845	-	-
21	35.705	-	-
18	34.84	-	-
19	33.86	-	YES
17	31.72	-	-
22	29.635	-	-
15	27.665	-	-
10	25.585	-	-
16	24.585	-	-
13	21.02	-	-
14	16.94	-	-
11	12.81	-	-
26	10.255	180	-
29 & 36	-	22 & 55	-
28 & 37	-	310 & 340	-
27 & 38	-	92 & 116	-
35	-	144	-
30 & 31	-	133 & 220	-
32 & 33	-	50 & 300	-
39 & 41	-	60 & 310	-
42 & 43	-	140 & 230	-
34	-	56	YES
23 & 25	-	-	YES
12	32.20	-	-
24	24.85	-	-
20 & 40	Reference temperature	-	-

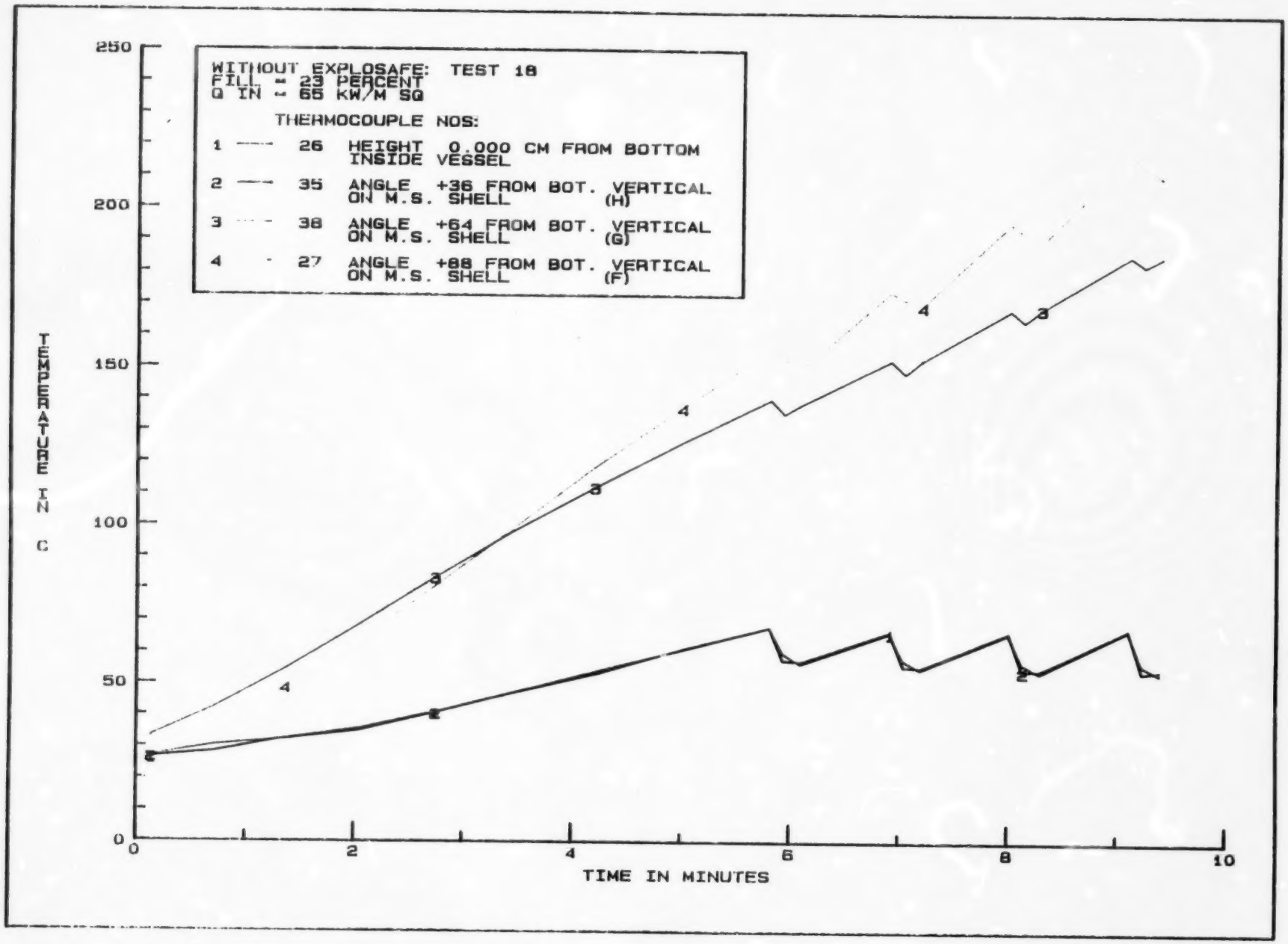
Fig. III.B A grid layout of thermocouples along with their locations for an unprotected vessel(UNB) with the PRV orifice of 3/8 in. (Valid for 76, 58 and 23 percent liquid full cases)

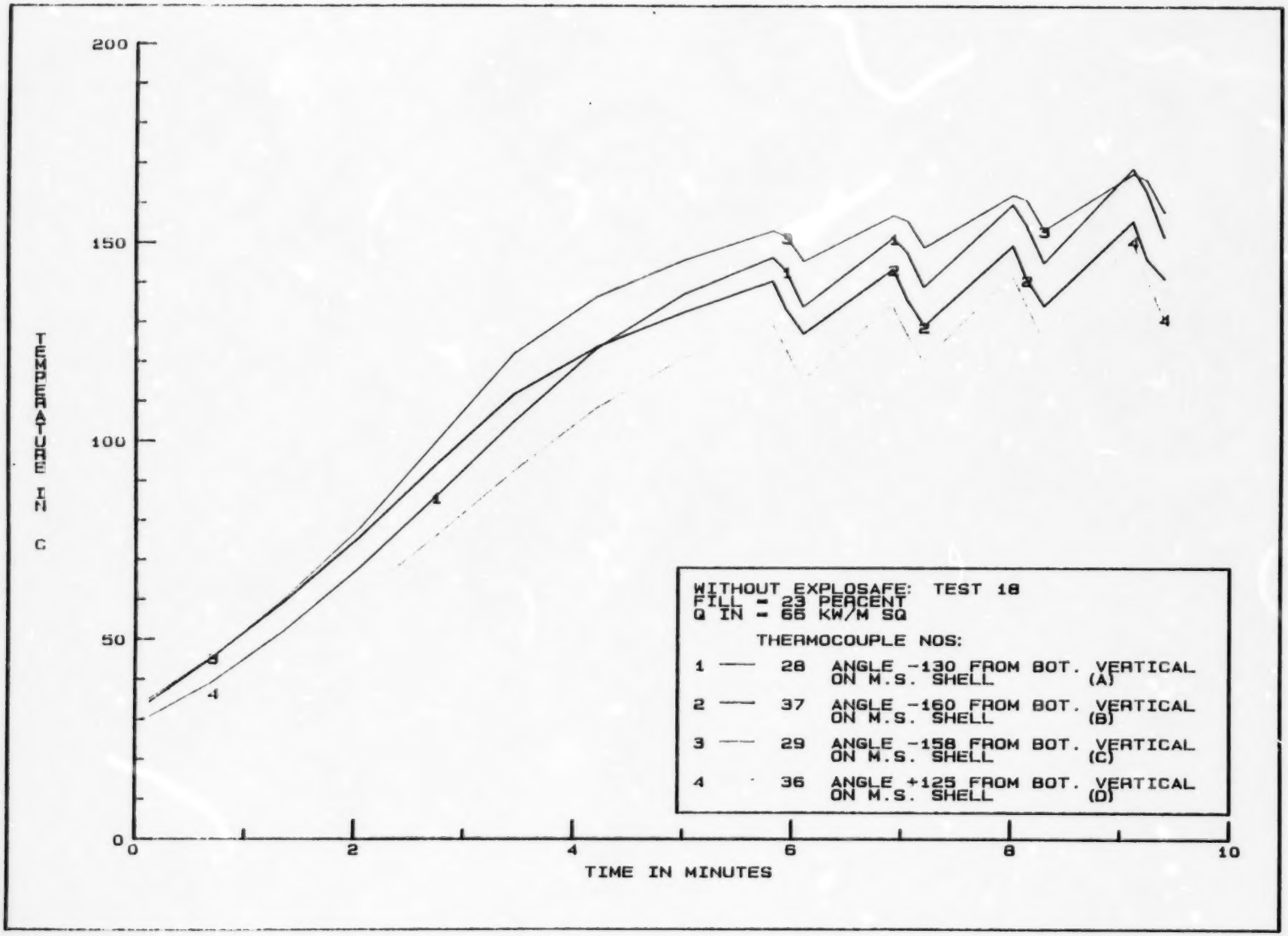
FOLLOWING THERMOCOUPLES ARE PLACED

ON THE MILD STEEL SHELL OR

INSIDE THE MILD STEEL SHELL

THERMOCOUPLE NUM.	ANGLE FROM BOTTOM VERTICAL
ON THE MILD STEEL SHELL:	
26 OR I	00
27 OR F	+88
28 OR A	−130
29 OR C	−158
35 OR H	+36
36 OR D	+125
37 OR B	−160
38 OR G	+64
INSIDE THE MILD STEEL SHELL:	
34 OR E	+124

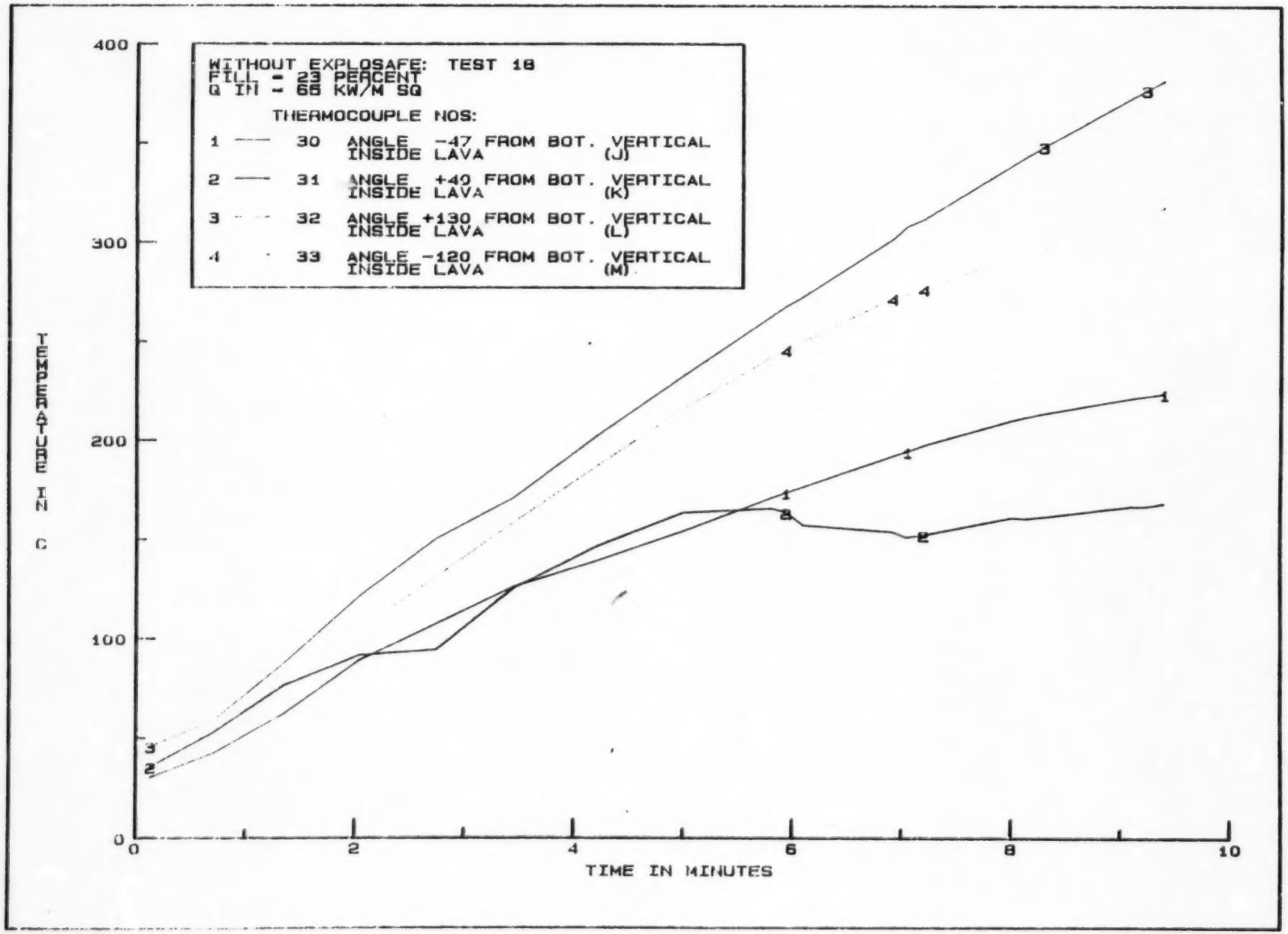

WITHOUT EXPLOSAFE: TEST 18
FILL = 23 PERCENT
Q IN = 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 26 HEIGHT 0.000 CM FROM BOTTOM INSIDE VESSEL
2 —— 35 ANGLE +36 FROM BOT. VERTICAL ON M.S. SHELL (H)
3 —— 38 ANGLE +64 FROM BOT. VERTICAL ON M.S. SHELL (G)
4 —— 27 ANGLE +88 FROM BOT. VERTICAL ON M.S. SHELL (F)
TEMPERATURE IN C
250
200
150
100
50
0
0
2
4
6
8
10
TIME IN MINUTES


200
150
100
50
0
TEMPERATURE IN C
0
2
4
6
8
10
TIME IN MINUTES
WITHOUT EXPLOSAFE: TEST 18
FILL = 23 PERCENT
Q IN = 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 28 ANGLE -130 FROM BOT. VERTICAL ON M.S. SHELL (A)
2 —— 37 ANGLE -160 FROM BOT. VERTICAL ON M.S. SHELL (B)
3 —— 29 ANGLE -158 FROM BOT. VERTICAL ON M.S. SHELL (C)
4 36 ANGLE +125 FROM BOT. VERTICAL ON M.S. SHELL (D)

FOLLOWING THERMOCOUPLES ARE PLACED IN THE LAVA MEDIUM

THERMOCOUPLE NUM.	ANGLE FROM BOTTOM VERTICAL
30 OR J	-47
31 OR K	+40
32 OR L	+130
33 OR M	-120

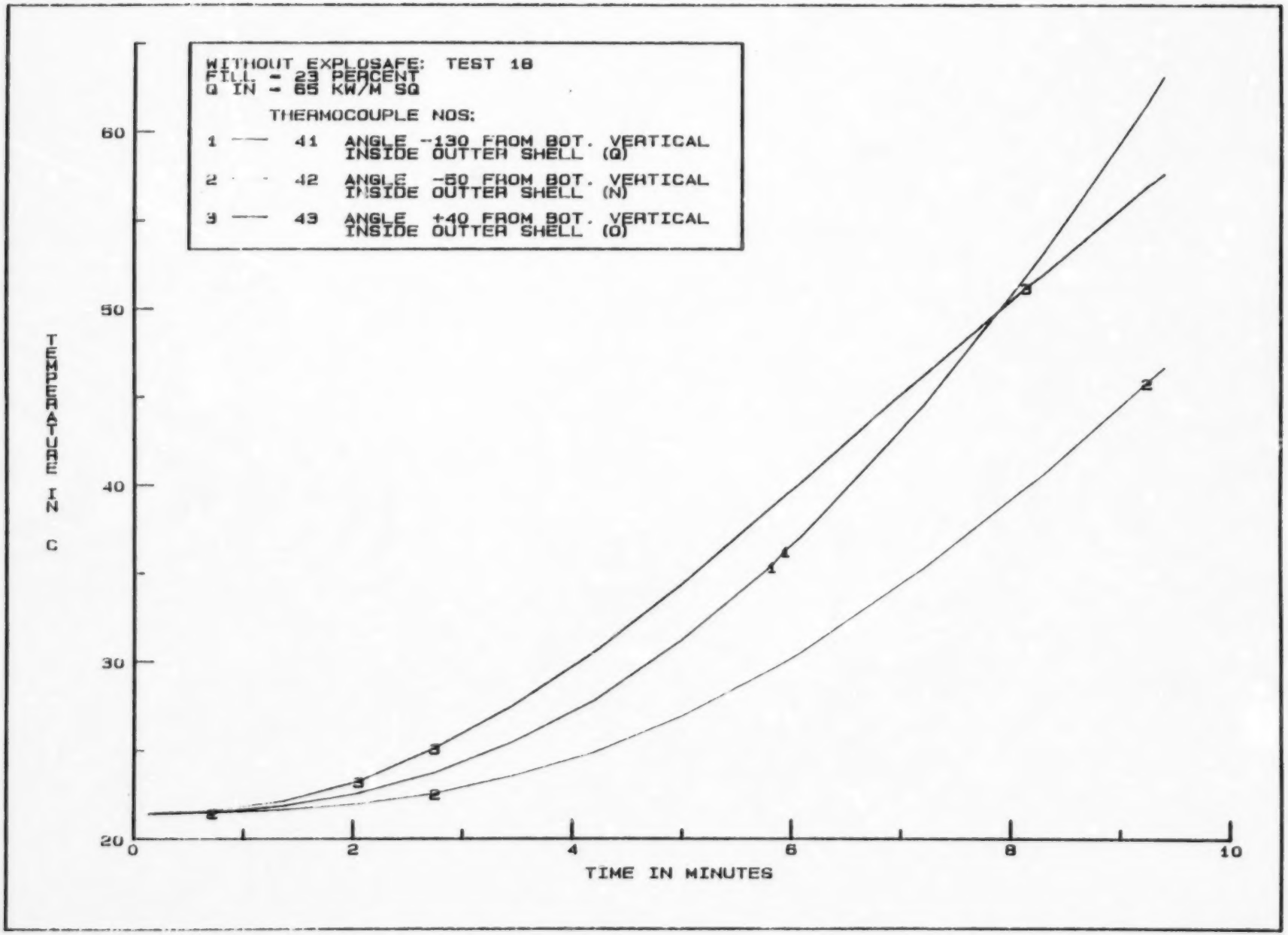
ALL FOUR PLOTS ARE GIVEN ON ONE PAGE


WITHOUT EXPLOSAFE: TEST 18
FILL = 23 PERCENT
Q IN = 68 KW/M SQ
THERMOCOUPLE NOS:
1 —— 30 ANGLE -47 FROM BOT. VERTICAL INSIDE LAVA (J)
2 —— 31 ANGLE +40 FROM BOT. VERTICAL INSIDE LAVA (K)
3 - - - 32 ANGLE +130 FROM BOT. VERTICAL INSIDE LAVA (L)
4 · · · 33 ANGLE -120 FROM BOT. VERTICAL INSIDE LAVA (M)
TEMPERATURE IN C
400
300
200
100
0
0
2
4
6
8
10
TIME IN MINUTES

FOLLOWING THERMOCOUPLES ARE PLACED INSIDE THE OUTTER SHELL

THERMOCOUPLE NUM.	ANGLE FROM BOTTOM VERTICAL
39 OR P	+120
41 OR Q	-130
42 OR N	-50
43 OR O	+40

ALL FOUR PLOTS ARE GIVEN ON ONE PAGE


WITHOUT EXPLOSAFE: TEST 18
FILL - 23 PERCENT
Q IN - 65 KW/M SQ
THERMOCOUPLE NOS:
1 —— 41 ANGLE -130 FROM BOT. VERTICAL INSIDE OUTTER SHELL (Q)
2 - - 42 ANGLE -50 FROM BOT. VERTICAL INSIDE OUTTER SHELL (N)
3 —— 43 ANGLE +40 FROM BOT. VERTICAL INSIDE OUTTER SHELL (O)
TEMPERATURE IN C
60
50
40
30
20
0
2
4
6
8
10
TIME IN MINUTES

TEST 18

WITHOUT EXPLOSAFE

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITHOUT EXPLOSAFE - FILE NAME : TEST 10

DATE OF TEST = FEB 20,1984 Q IN = 65 KW/M SQ LIQUID LEVEL = 23 PERCENT

SET PRESSURE = 35 PSIG PRV ORIFICE DIAMETER = 3/8 INCHES

	TIME MINS	PRESSURE PSIG	THRM#1 C	THRM#2 C	THRM#3 C	THRM#4 C	THRM#5 C	THRM#6 C	THRM#7 C	THRM#8 C	THRM#9 C	THRM#10 C	THRM#11 C
1.	0.132	0.589	24.147	23.013	975.100	23.186	24.861	23.581	22.741	24.515	22.544	22.148	22.395
2.	0.711	1.418	27.844	25.933	*******	26.081	29.089	27.012	25.467	28.528	25.026	23.547	24.286
3.	1.358	3.364	34.273	31.539	*******	31.491	35.838	32.944	30.787	35.020	29.765	26.614	27.545
4.	2.047	6.338	42.352	40.165	*******	39.640	42.613	41.283	38.565	42.399	36.625	31.849	33.132
5.	2.743	10.475	53.371	50.018	*******	48.943	51.488	51.208	48.216	51.651	45.490	39.108	39.084
6.	3.452	15.782	65.684	61.748	*******	60.811	67.403	63.776	58.909	67.019	54.482	47.206	45.188
7.	4.206	22.863	81.742	72.550	*******	72.729	85.431	78.960	68.889	83.106	64.795	56.166	51.949
8.	4.999	31.452	92.198	84.684	*******	83.872	97.822	88.049	80.505	94.984	76.718	64.680	58.926
9.	5.813	41.566	105.670	95.736	*******	96.597	109.160	102.610	90.375	107.040	87.612	73.262	65.971
10.	5.938	23.344	105.480	96.656	*******	96.492	102.850	101.250	91.094	99.858	87.615	72.504	62.998
11.	6.095	27.555	75.165	76.122	*******	75.277	65.002	76.700	74.139	69.342	71.522	63.775	53.972
12.	6.914	39.702	108.270	100.780	*******	102.500	110.000	107.530	95.438	107.030	91.029	72.303	64.431
13.	7.043	20.889	108.510	102.930	*******	103.420	108.020	106.420	96.388	103.550	91.878	73.090	61.542
14.	7.195	25.570	77.572	79.587	*******	78.791	68.402	79.897	76.262	73.341	74.123	64.895	51.841
15.	8.006	39.624	113.450	107.810	*******	107.490	117.560	111.600	102.000	114.120	97.312	75.878	64.481
16.	8.135	19.894	113.850	109.230	*******	108.030	115.110	110.620	103.220	110.070	98.839	74.903	61.067
17.	8.292	25.101	82.016	84.302	*******	83.314	68.787	84.060	81.928	74.594	78.882	65.169	51.168
18.	9.108	41.390	121.660	115.940	*******	116.150	124.990	120.150	111.710	122.760	105.740	82.256	65.235
19.	9.238	19.073	123.190	117.890	*******	117.320	123.030	119.820	112.980	118.010	107.270	82.656	61.619
20.	9.397	24.874	84.349	87.542	*******	85.992	67.528	86.691	85.992	75.912	82.438	69.489	50.542

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITHOUT EXPLOSAFE - FILE NAME : TEST 18

DATE OF TEST = FEB 20,1984 Q IN = 65 KW/M SQ LIQUID LEVEL = 23 PERCENT

SET PRESSURE = 35 PSIG PRV ORIFICE DIAMETER = 3/8 INCHES

	TIME MINS	PRESSURE PSIG	THRM#12 C	THRM#13 C	THRM#14 C	THRM#15 C	THRM#16 C	THRM#17 C	THRM#18 C	THRM#19 C	THRM#20 C	THRM#21 C	THRM#22 C
1.	0.132	0.589	23.038	22.445	22.643	22.198	22.198	22.346	22.445	885.100	2.390	23.136	22.885
2.	0.711	1.418	25.467	24.262	24.311	23.646	23.621	24.286	24.902	980.750	2.392	25.516	24.459
3.	1.358	3.364	30.276	27.569	27.887	27.153	26.590	28.937	29.644	*******	2.394	30.325	28.791
4.	2.047	6.338	37.872	32.890	33.035	33.591	31.607	35.423	36.961	*******	2.396	37.800	35.327
5.	2.743	10.475	49.411	38.988	38.845	41.609	37.313	44.357	45.843	*******	2.397	46.737	43.719
6.	3.452	15.782	62.387	44.875	45.016	49.993	45.794	54.459	56.677	*******	2.399	57.345	52.882
7.	4.206	22.863	73.668	52.111	51.949	59.983	54.456	64.432	66.880	*******	2.402	66.812	62.657
8.	4.999	31.452	85.822	59.201	59.857	69.427	62.723	74.871	77.672	*******	2.404	78.493	72.055
9.	5.813	41.566	96.231	66.424	66.016	77.405	70.977	84.967	89.202	*******	2.406	90.571	81.452
10.	5.938	23.344	94.964	60.806	61.972	76.652	70.014	84.246	87.135	*******	2.406	86.873	79.490
11.	6.095	27.555	79.736	55.592	54.134	66.272	63.206	69.995	72.373	*******	2.407	72.799	68.215
12.	6.914	39.702	95.868	65.271	64.749	70.688	69.609	86.064	90.921	*******	2.409	92.524	81.256
13.	7.043	20.899	97.097	59.780	60.765	73.648	70.355	85.587	90.034	*******	2.409	90.100	79.759
14.	7.195	25.570	80.912	55.713	53.026	65.711	63.463	71.034	74.435	*******	2.410	74.904	68.475
15.	8.006	39.624	101.760	67.335	64.935	81.679	74.497	91.922	96.130	*******	2.412	99.006	86.549
16.	8.135	19.884	102.830	66.549	59.670	78.835	71.482	90.582	95.640	*******	2.412	96.006	83.465
17.	8.292	25.101	85.003	62.786	52.959	67.727	63.169	74.616	77.885	*******	2.413	78.638	71.395
18.	9.108	41.390	109.650	72.642	66.368	87.754	80.095	98.904	102.940	*******	2.415	106.120	93.851
19.	9.238	19.073	110.920	73.412	60.430	88.150	79.524	97.964	101.690	*******	2.415	101.960	91.410
20.	9.397	24.874	91.022	67.030	52.498	72.699	67.821	78.465	81.492	*******	2.415	82.460	75.890

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITHOUT EXPLOSAFE - FILE NAME : TEST 18

DATE OF TEST = FEB 20,1984 Q IN = 65 KW/M SQ LIQUID LEVEL = 23 PERCENT

SET PRESSURE = 35 PSIG PRV ORIFICE DIAMETER = 3/8 INCHES

	TIME MINS	PRESSURE PSIG	THRM#23 C	THRM#24 C	THRM#25 C	THRM#26 C	THRM#27 C	THRM#28 C	THRM#29 C	THRM#30 C	THRM#31 C	THRM#32 C	THRM#33 C
1.	0.132	0.589	*******	23.704	0.000	26.303	29.964	30.464	34.170	30.137	35.511	45.786	39.849
2.	0.711	1.418	0.000	25.025	0.000	28.151	37.459	39.349	45.365	42.570	52.979	59.010	57.015
3.	1.358	3.364	*******	28.522	*******	32.346	48.611	52.055	60.158	62.562	76.780	88.133	79.178
4.	2.047	6.330	*******	34.291	*******	38.606	65.408	67.902	77.897	89.466	92.052	121.880	104.740
5.	2.748	10.475	0.000	41.894	0.000	46.766	80.482	86.815	99.722	107.680	94.748	150.570	131.230
6.	3.452	15.782	0.000	50.740	*******	56.912	99.788	104.820	122.010	126.680	126.950	171.330	158.780
7.	4.206	22.863	*******	59.938	*******	63.704	118.410	123.320	136.380	139.650	146.930	202.260	186.950
8.	4.999	31.452	*******	68.278	*******	60.660	137.100	137.010	145.670	154.690	163.960	232.770	216.010
9.	5.813	41.566	0.000	76.427	*******	67.864	155.600	146.380	153.090	171.540	166.120	263.070	242.410
10.	5.938	23.344	0.000	74.225	*******	59.653	152.640	142.900	151.440	173.940	163.970	267.760	245.980
11.	6.095	27.555	0.000	67.380	*******	56.363	149.630	133.850	145.350	176.890	157.440	272.630	250.250
12.	6.914	39.702	0.000	77.164	*******	66.358	174.110	151.320	156.950	192.280	153.970	301.680	271.970
13.	7.043	20.899	*******	75.633	*******	57.501	171.530	147.450	155.360	194.640	151.270	308.080	273.810
14.	7.195	25.570	0.000	67.521	0.000	54.698	169.580	138.880	148.010	197.600	152.580	311.720	276.630
15.	8.006	39.624	*******	81.172	*******	66.275	195.750	159.770	162.140	210.140	161.180	338.970	292.780
16.	8.135	19.894	*******	79.587	*******	56.589	192.560	154.320	160.680	211.710	160.500	343.250	294.140
17.	8.292	25.101	0.000	70.430	*******	53.803	189.840	144.990	153.260	213.630	161.500	348.270	296.240
18.	9.108	41.390	*******	86.663	*******	67.540	217.880	168.820	167.520	221.460	166.740	373.070	309.870
19.	9.238	19.073	*******	83.974	0.000	56.394	214.370	162.790	165.720	222.490	166.640	376.850	313.050
20.	9.397	24.874	*******	72.631	0.000	53.587	210.340	151.510	157.800	223.700	168.070	381.510	317.670

DATA OF A TEST CARRIED OUT ON THE UNB TANK 2 WITHOUT EXPLOSAFE - FILE NAME : TEST 18

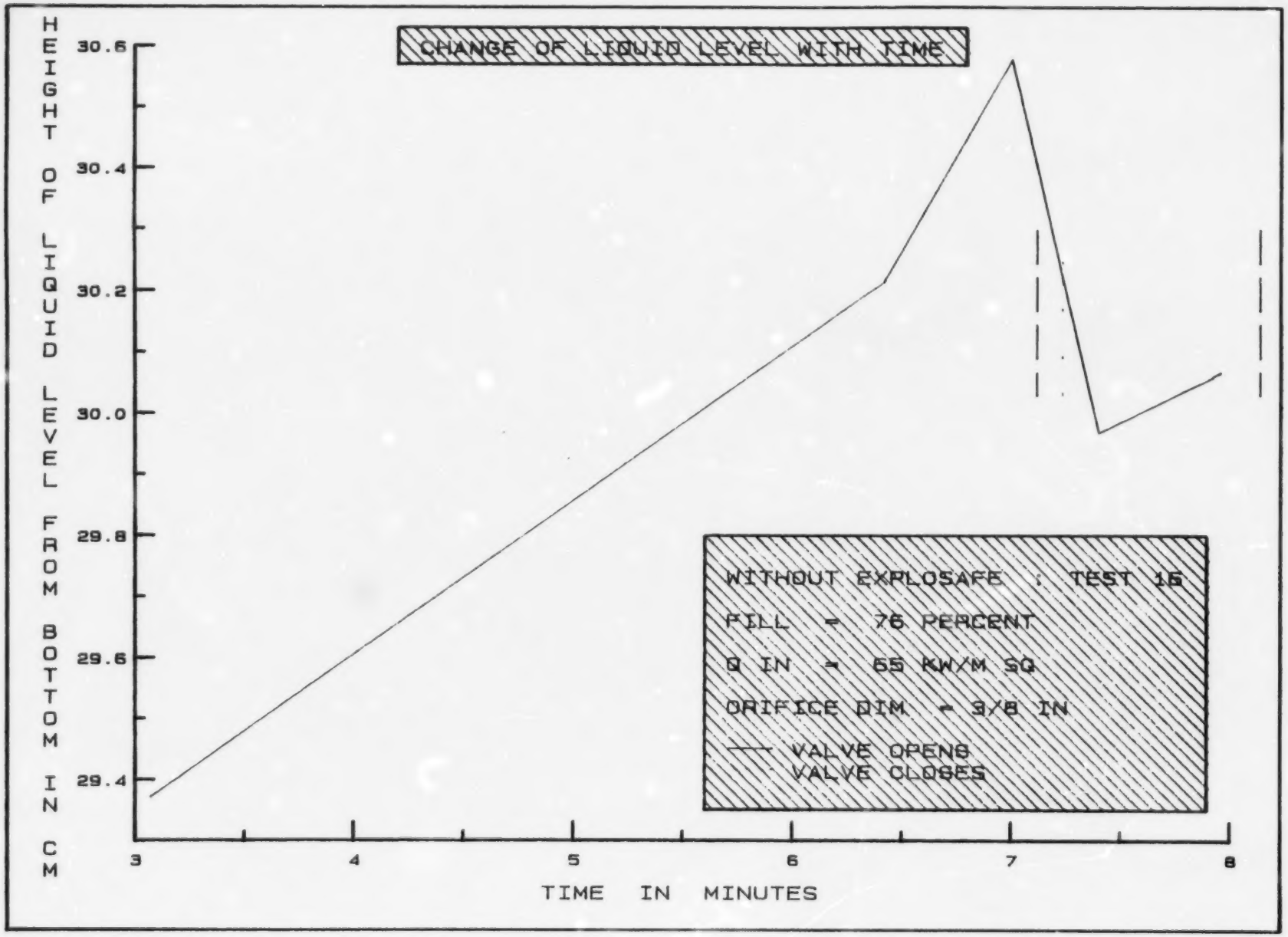
DATE OF TEST = FEB 20,1984 Q IN = 65 KW/M SQ LIQUID LEVEL = 23 PERCENT

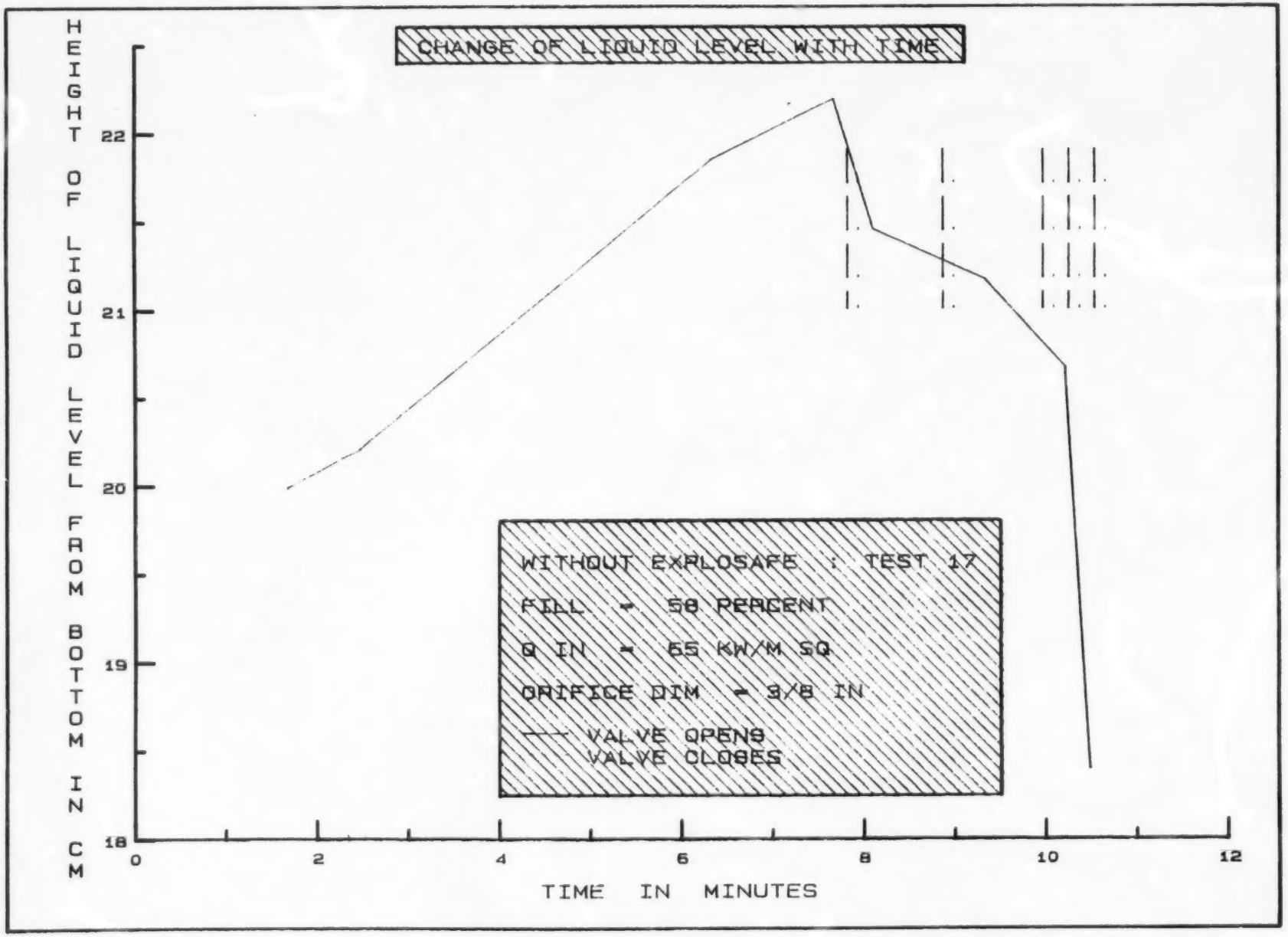
SET PRESSURE = 35 PSIG PRV ORIFICE DIAMETER = 3/8 INCHES

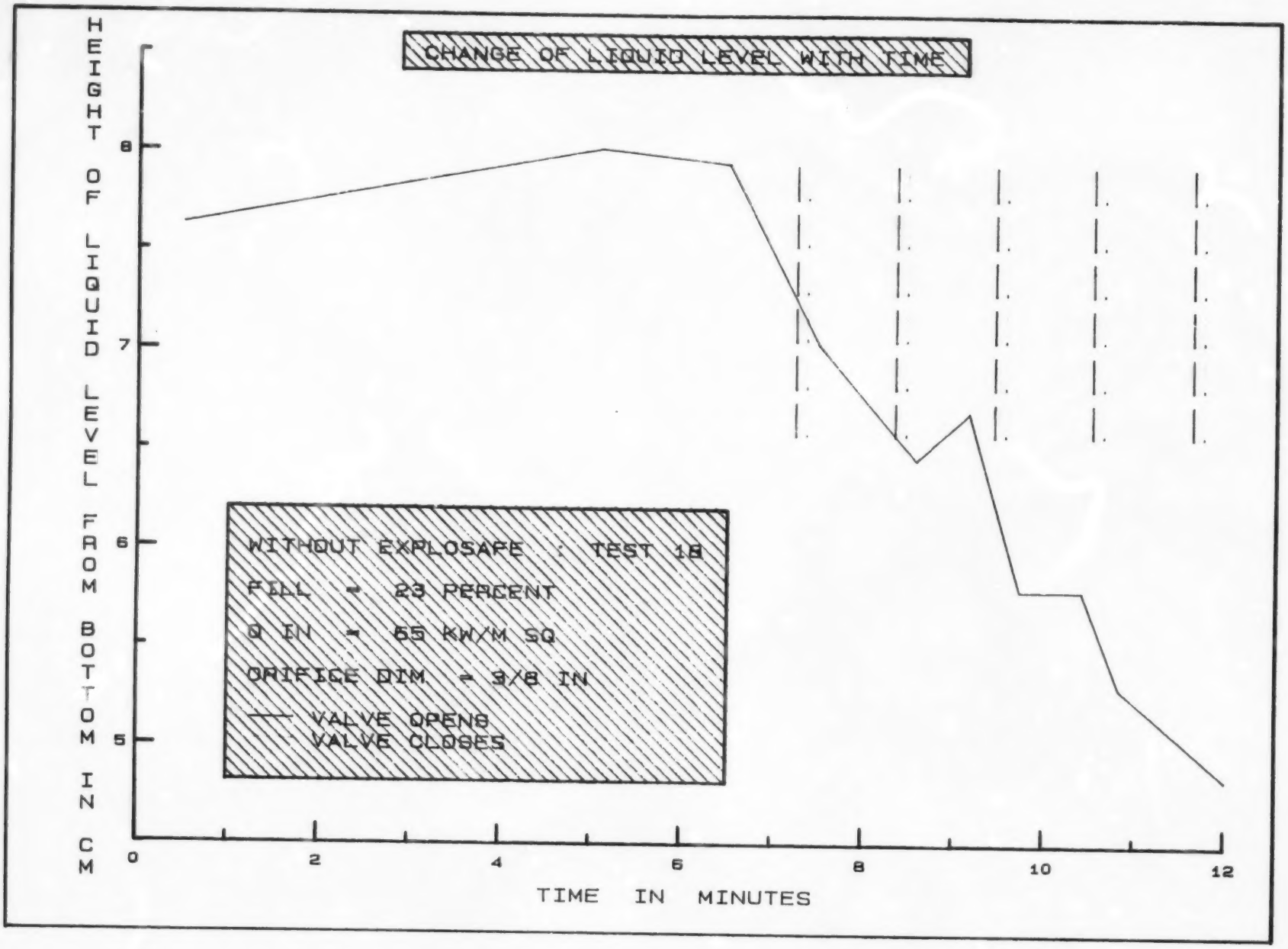
	TIME MINS	PRESSURE PSIG	THRM#34 C	THRM#35 C	THRM#36 C	THRM#37 C	THRM#38 C	THRM#39 C	THRM#40 C	THRM#41 C	THRM#42 C	THRM#43 C
1.	0.132	0.599	30.791	26.727	29.425	34.936	33.077	850.850	2.333	21.369	21.447	21.427
2.	0.711	1.418	38.433	30.211	36.575	45.574	42.190	*******	2.334	21.501	21.501	21.618
3.	1.358	3.364	49.874	32.134	47.341	59.387	54.302	*******	2.336	21.852	21.658	22.123
4.	2.047	6.338	64.870	34.840	60.667	75.665	68.445	0.000	2.338	22.571	21.989	23.248
5.	2.743	10.475	82.338	40.556	75.890	93.937	83.395	0.000	2.340	23.734	22.572	25.126
6.	3.452	15.782	101.730	46.779	92.372	111.750	98.033	0.000	2.343	25.459	23.564	27.505
7.	4.206	22.863	122.230	52.930	108.250	123.690	112.120	*******	2.345	27.851	24.917	30.604
8.	4.999	31.452	138.170	60.830	120.990	132.490	126.210	*******	2.347	31.284	26.971	34.431
9.	5.813	41.566	151.870	67.901	130.210	140.430	139.950	*******	2.350	35.452	29.598	38.779
10.	5.938	23.344	149.280	57.395	123.460	133.050	135.290	0.000	2.350	36.315	30.023	39.430
11.	6.095	27.555	143.340	57.079	115.630	127.010	138.560	*******	2.351	37.161	30.604	40.216
12.	6.914	39.702	163.180	66.807	134.470	143.470	152.440	*******	2.353	42.563	34.082	44.693
13.	7.043	20.899	159.560	55.485	127.340	135.480	148.120	*******	2.353	43.480	34.661	45.381
14.	7.195	25.570	154.280	55.282	120.280	129.060	152.510	0.000	2.354	44.474	35.279	46.164
15.	8.006	39.624	176.900	66.724	142.150	149.390	168.390	*******	2.356	50.790	39.239	50.469
16.	8.135	19.894	174.090	54.365	134.560	140.850	164.660	0.000	2.356	51.815	39.853	51.172
17.	8.292	25.101	166.560	54.785	125.680	134.080	169.020	0.000	2.357	53.124	40.583	51.896
18.	9.108	41.390	191.470	67.914	150.780	155.600	185.640	*******	2.359	60.322	45.039	56.163
19.	9.238	19.073	186.930	54.000	141.370	145.760	182.350	*******	2.359	61.492	45.765	56.847
20.	9.397	24.874	179.030	54.757	131.190	140.940	185.400	0.000	2.360	63.071	46.604	57.565

"Change Of Liquid Level With Time

Tests 15, 16 and 17"


CHANGE OF LIQUID LEVEL WITH TIME
HEIGHT OF LIQUID LEVEL FROM BOTTOM IN CM
30.6
30.4
30.2
30.0
29.8
29.6
29.4
3
4
5
6
7
8
TIME IN MINUTES
WITHOUT EXPLOSAFE : TEST 16
FILL = 76 PERCENT
Q IN = 55 KW/M SQ
ORIFICE DIM = 3/8 IN
VALVE OPENS
VALVE CLOSES


CHANGE OF LIQUID LEVEL WITH TIME
HEIGHT OF LIQUID LEVEL FROM BOTTOM IN CM
22
21
20
19
18
0
2
4
6
8
10
12
TIME IN MINUTES
WITHOUT EXPLOSAFE : TEST 17
FILL = 58 PERCENT
Q IN = 55 KW/M SQ
ORIFICE DIM = 3/8 IN
VALVE OPENS
VALVE CLOSES


CHANGE OF LIQUID LEVEL WITH TIME
HEIGHT OF LIQUID LEVEL FROM BOTTOM IN CM
8
7
6
5
WITHOUT EXPLOSAFE : TEST 18
FILL = 23 PERCENT
Q IN = 65 KW/M SQ
ORIFICE DIM = 3/8 IN
VALVE OPENS
VALVE CLOSES
0
2
4
6
8
10
12
TIME IN MINUTES